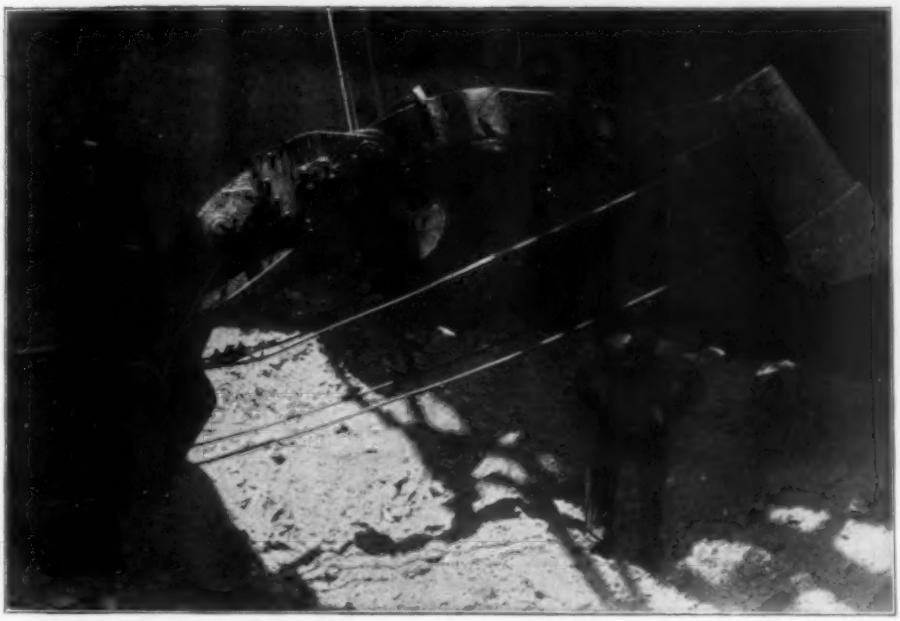
POPULAR MECHANICS

Vol. 10. OCTOBER, 1908. No. 10

NEW CLAM-SHELL BUCKET HAS 18-FOOT REACH



The Mammoth Jaws Close with a Force Which Would Bite a Man in Two as Easily as a Child Cuts a Pile of Sand

Vessel owners and dock operators are greatly interested in a new design of clam-shell bucket invented by a Cleveland man and now in operation on one of the ore docks of that city. Its main feature is the fact that it possesses the extremely wide opening or reach of 18 ft. 1 in. inside measurement, which is 5 ft. greater than any bucket now on the market, and that it has obtained this without increasing the height or complexity of its construction.

The advantage of such a reach in scraping or cleaning up the cargo in the hold of a vessel is obvious, and its advantages in discharging the cargo from a 24-ft. center boat with hatch openings running 12 ft. fore and aft practically eliminate shoveling by hand. One of its greatest advantages is the fact that it will heel and reach to its full opening even though it is dropped on no more than half a bucket of ore. One of the illustrations shows how it extends to its full length. This is an important consideration when it is necessary to reach out and unload ore from under another hatch.

The bucket can be operated on any design of unloader using either steam or electricity. Its parts are few and durable and there is little to wear out.

Clam-Shell Bucket Closed

SHIP'S SPEED INCREASED BY LESSENING FRICTION

Some remarkable experiments have been carried out at Cherbourg in testing the invention of a Belgian for increasing the speed of ships by lessening friction. The system consists of enveloping the ship, so to speak, in a jacket of air, thus obviating all friction and the resistance of water. This is accomplished by nine blowing machines, placed forward, aft and under the apertures in the hull below the water line.

The trial ship, an ordinary 800-hp. ocean "tramp" steamer, not able to make more than 12 miles an hour, was made to steam 14 miles an hour by the application of the system. The most satisfactory test was made by an armored cruiser which took the tramp in tow and made a speed of 23 miles an hour. This was an astonishing result, as the dead weight of the "tramp," or what would under ordinary circumstances have been the dead weight, seemed hardly to retard the speed of the tugging cruiser at all.

The result of the trial with the cruiser was considered extremely curious, but not altogether convincing. As far as obviating the resistance of water is concerned, it would seem that, whether the hull is immediately surrounded with air or not, it must displace an equivalent volume of water, and in order to do so must perpetually overcome resistance while moving through the sea. There is, however, apparent ground for concluding that, from whatever cause arising, there is a notable increase of speed, and it is probably to be sought in diminished friction alone.

A BARBER STATION IN INDIA

A train fitted up with a barber shop is generally regarded as a refined convenience, but in India the desired service is provided without going to any such expense. Each station has its native barbers, and the job is done as shown in this illustration, which was

Shaving a Passenger

taken while a British troop train on its way to the frontier was making a stop.

U. S. WARSHIPS MAY LOSE THEIR WHITE COATS

If Secretary Metcalf has his way, the custom of painting American warships white above the water line in times of peace will be abandoned in favor of the slate color used in times of war. The white color, it is said, has been adhered to not only on account of appearance but because it imparts a certain degree of coolness, which is an important consideration for vessels in tropical waters.

UNIQUE AUTOMOBILE RACE COURSE FOR AMUSEMENT PARKS

The latest novelty for amusement parks is the automobile race course, invented by two men living at Oakland, Cal. Ordinary automobiles are used, but they are electrically driven over a wooden track. The novelty of the course is in the fact that each trip is an actual race, as the speed of the automobiles, starting at the same time, will vary from 25 to 30 miles an hour, and it is uncertain which will complete the course first. The variation in speed is caused by an automatic rheostat.

The cars, however, are at all times under the control of an operator on the bridge, and in case of trouble of any kind he can shut off the current and bring them to an immediate stop. In the middle of each track is a raised runway upon which runs a small guide wheel attached to the front of the machines. This acts as a safety device and makes it impossible for the automobiles to swerve from their course.

A "TREADMILL" FERRY BOAT

That the steam and motor engine has not yet totally superseded the crude means by which our great-great-grand-

Courtesy of Motor Boat

Horse-Propelled Ferry

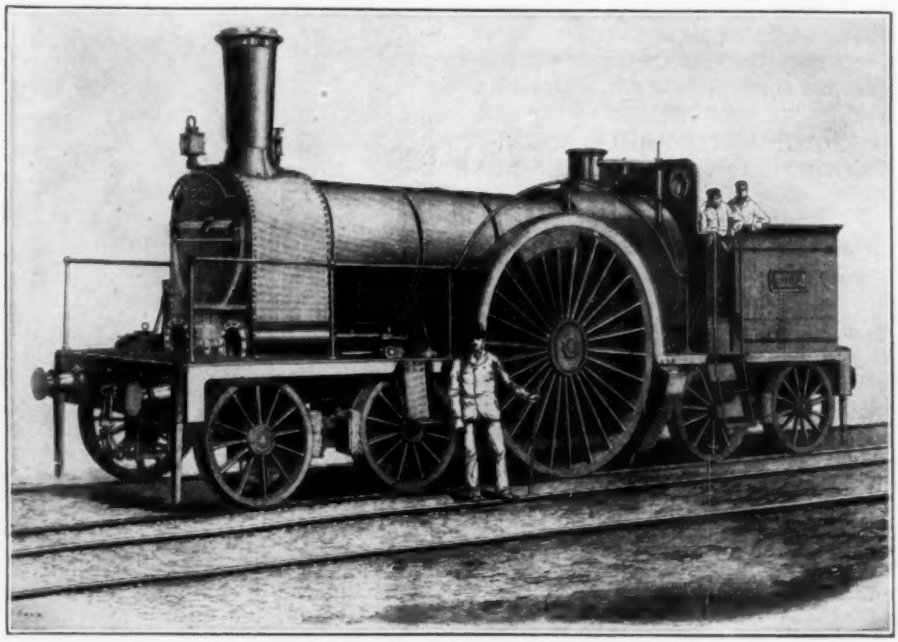
fathers accomplished things, is aptly shown in this illustration. This ferry still crosses and recrosses the Ottawa river near Montreal, Canada, as in the days of old. The treadmill or revolving floor on which the horses work is connected by a chain and sprocket to

Ordinary Automobiles, Electrically Driven, Furnish Exciting Races

the propelling wheel in the stern. Though primitive in design and operation, no one could call it anything but a 2-hp. machine.

HUGE DRIVE WHEELS ON OLD LOCOMOTIVE

This old engine was fitted with driving wheels 9 ft. in diameter, and it is claimed that it was capable of traveling at a speed of 80 miles an hour. It was



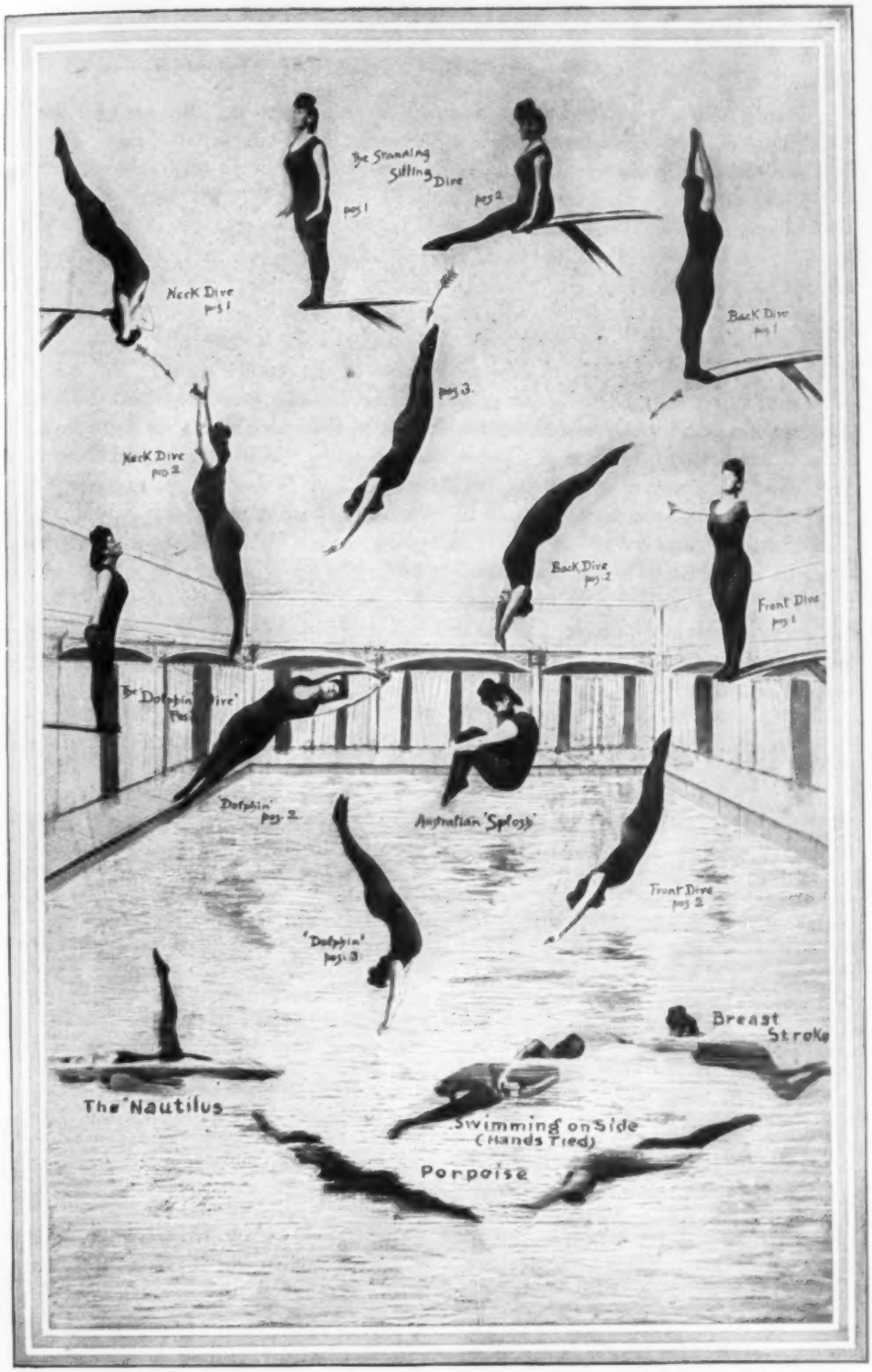
Nine-Foot Driving Wheels Were Used in 1850

built in 1850 for the Bristol & Exeter railway, England, and broken up in 1867.

WATER PRESSURE AT DIFFERENT DEPTHS

If a vessel has the flattest part of her bottom lying 16 ft. deep, the water then presses 16 times as much upwards against this flat part as it does upon any part of the same ship about the water's edge; and so on any other part, according to the depth, says the Marine Review. For example, suppose a vessel to have four leaks, or plug holes of equal size, that could be driven out occasionally—the first at 1 ft. under water, the second at 4 ft., the third at 9 ft., and the lowest at 16 ft. in the flat part of her bilge; that hole at 4 ft. deep would leak or let in as much water again, in the same time, as that at 1 ft.; and that at 9 ft. three times as much; and that at 16 ft. four times as much, though it run into the vessel upwards; and so on in proportion to the square root of the height of the water above the leak or plug hole. Therefore leaks in vessels are more or less dangerous, according to their depth under water. On first springing a leak it will rush in faster until the water inside is as high as the place where the leak is, and will pour in less the higher it gets inside.

A kite flown from the weather bureau station at Mount Weather, Va., reached a height of 16,300 ft. The temperature at that height was found to be 20 degrees, although on the surface it was 75.



This illustration shows a number of the diving poses of Annette Kellerman, the famous Australian diver. She is spoken of as the "human fish," and undoubtedly is as much at home in the water as the ordinary person is on dry land.

A MONTH OF REMARKABLE AERIAL FLIGHTS

History tells us that the ancients dreamed of aerial flight and that primitive man watched the birds, tried to imitate, and failed. Records show that as far back as 1600 men devised wild schemes for flight and drew crude models of their ideas. In 1783 a sheep, a chicken and a duck were sent up in the basket of a balloon in France. This was the first time any living creature ascended with any kind of an aerostatic machine. The barnyard denizens came down safely and, given courage by this fact, M. Pilatre de Rozier ascended a few weeks later and became the first aeronaut. In 1785 he fell from his balloon and was killed. The first attempt to steer a balloon was made over Paris in 1784.

From such a humble beginning has the science of aerial navigation progressed until now success is assured, and the whole world is interested and ready to believe. The month of August, 1908, will go down in history as a remarkable period of aerial activities. Within its scope Zeppelin's great dirigible balloon flew over 450 miles, ending its flights by an accident which totally wrecked it; Captain Baldwin made a series of successful flights at Fort Myer, the government accepting his dirigible balloon; Wilbur Wright astonished all Europe by his wonderful maneuvers with his aeroplane in France, and Henry Farman, the great French aeronaut, astonished New York by his aeroplane flights and the rapidity with which he hurried back "to that dear Paris."

What wonderful flights the near future will bring forth can only be conjectured, but it is quite probable in the couple of weeks that will elapse while this issue is going through the hands of the printers that new and more remarkable records will be made at Fort Myer and in France.

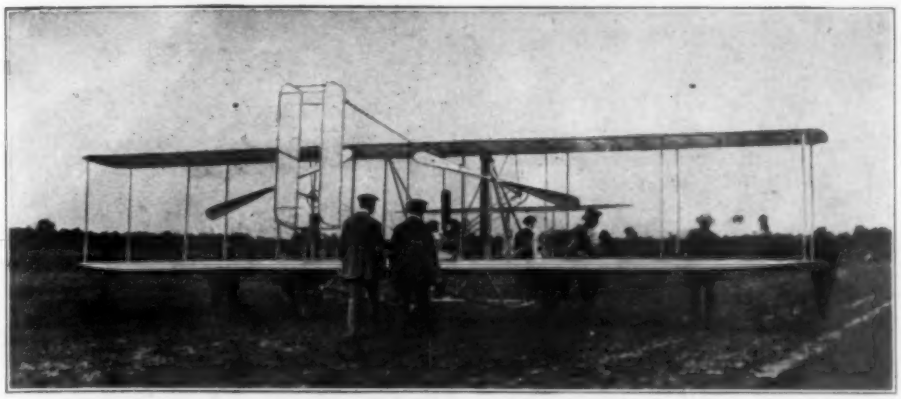
FIRST OFFICIAL FLIGHTS OF THE WRIGHTS

The skepticism with which the aeronautic experts in America, as well as in Europe, have received the many reports of the wonders of the Wright aeroplane has at last been effectually routed by the official flights made by Wilbur Wright in Paris during the month of August.

The tests were truly wonderful, proving without doubt that Wilbur and Orville Wright have a control over their machine that no other aviator can yet claim, and scientists all over the world are now as ready with praise as they were formerly ready to scoff. The praise is justified by recent developments, but no more so than skepticism was justifiable while the Wrights refused to prove their claims to the world.

The best flight made by Wilbur Wright in August was 3 miles in 3 min. 40 sec., which gives a speed of nearly 50 miles an hour. During this flight the aeroplane rose and fell like a bird, breasting the wind and utilizing its energy in a scientific manner. It was not the distance flown which the French aeronautic enthusiasts thought so wonderful, but the marvelous control Wilbur Wright has over the machine. By a system of inclining the wings, the machine is enabled to describe intricate evolutions that equal those of a swallow for grace and beauty. So complete is the control that even M. Delagrange, the greatest French rival of the Wrights, exclaimed "Magnifique! Magnifique!" insisting that the aeroplane was wonderful and Wilbur Wright a marvel.

"In several ways the Wright machine is far in advance of its nearest competitor," says one of the great English magazines. "It is compact and light, and under marvelous control at all times. In appearance it is not unlike



The Wright Bros. Aeroplane at Le Mans, France

an elongated box kite without sides, and is composed of two planes about 40 ft. in length and 9 ft. wide, one above the other, 7 ft. apart, with the engine between. The engine has 4 cylinders and is water cooled. Alongside the engine sit the driver and passengers, or, if the operator is alone, ballast is carried instead. The two propellers are wooden and quite 9 ft. in diameter, and turn comparatively slowly. As they are geared in the ratio of 1 to 4 to the engine, they seldom exceed 250 or 300 revolutions per minute. For steering purposes two rudders are fitted, one in front and the other behind, doing away with the tail, which is so conspicuous a feature of the French aeroplanes."

On August 23 Baron d'Estournelles de Constant gave a luncheon at his country seat in honor of Wilbur Wright, and as president of one of the French societies he presented two medals to Mr Wright, one for himself and the other for his brother Orville, in commemoration of the occasion.

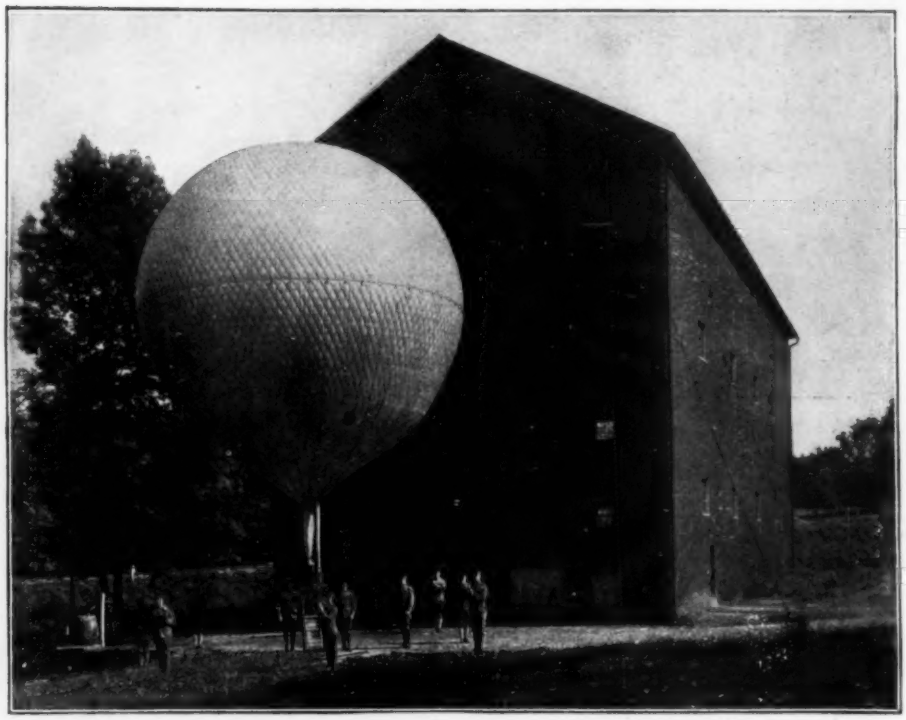
BALDWIN'S DIRIGIBLE AIRSHIP ACCEPTED BY THE UNITED STATES GOVERNMENT

The United States government has at last entered the peaceful international strife for the supremacy of the air in earnest. It now has a dirigible airship of its own and the next few months will see the experts of the United States Army Signal Corps hard at work at a task which a great many people will consider play, but which, in reality, is a series of scientific experiments without which a great war might easily prove disastrous. Recent airship flights have proven without any reasonable doubt that aerial warfare will prove a great factor in the battles of the future.

The man who succeeded in fulfilling the specifications by successful flights at the Fort Myer dirigible balloon test, and whose airship was accepted by General Allen, of the signal corps, is Captain Thomas S. Baldwin.

As far as construction is concerned, the Baldwin airship was accepted the first week of the tests, and on August 14 Captain Baldwin, with Glen E. Curtiss as an aid, made two flights, both of which were over the required speed of 16 miles an hour, but under the 20-mile specification without which the government would not pay the full contract price of $8,000. By these flights, however, Captain Baldwin was assured about $6,000 for his ship.

The specifications called for a dirigible balloon not longer than 120 ft., but capable of carrying two men having a combined weight of 250 lb., and at



Balloon Shed at Fort Myer and Detachment of Signal Corps Drilling

least 100 lb. of ballast. The gas envelop of the Baldwin dirigible is a little over 90 ft. long and embodies a number of ideas entirely different from his other attempts at airship building, the most important among these being an air bag within the gas envelop. This is located in the center of the gas envelop and is 25 ft. long. The purpose of this inner bag is to regulate the pressure of the gas under different atmospheric conditions, and is accomplished by pumping air into it when the gas envelop is not sufficiently filled out with gas and letting the air escape when the gas pressure is too high. Horizontal planes are used for elevating and lowering the airship. The propeller is 9 ft. in diameter.

The estimated yield of beets and sugar for the season of 1908-09 is 500,000 tons of sugar manufactured from a probable planting of 445,000 acres of beets.

FARMAN IN THE UNITED STATES

It is deeply regretted by the average American when a foreigner of world-wide fame comes to this country and leaves it with a shattered opinion of its hospitality and customs. It is a fact, however, that this sometimes happens, but the blame should be placed on the parties who are responsible, not upon the country as a whole.

Henry Farman, the French aviator whose wonderful flights have made his name famous all over the world, came to the United States in August at the invitation of a syndicate of men to make a series of flights. He flew a number of times in New York and then troubles arose with which he and his aeroplane could not compete and he had to ship his machine back to France secretly so that it would not be seized by creditors of the men who invited him to come here. It matters not where the blame lay, he left the United States

feeling that he had been badly treated, and will probably never wish to come here again.

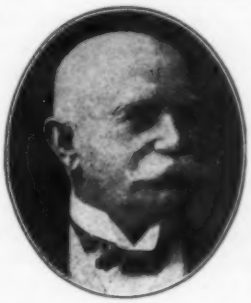
Wilbur Wright is in France, and, according to press reports, he is receiving the best of treatment.

ELECTRICITY FROM THE SKY FOR AIRSHIPS

Among the possibilities of the future for aerial navigation, according to Hudson Maxim, the great inventor, will be the wireless electric sky road or zones of electric energy, leading from center to center of population and industry, along which flying machines will pass to and fro, drawing their power from an electric system stretched along the earth, thus obviating the necessity of each individual flying machine developing its own energy. Each machine will carry an electric meter, and the consumer will pay for the energy used just as he now pays for the electric current which lights his residence.

Diplomatic relations between Persia and Greece have been renewed after a little matter of 2,399 years, by the appointment of a Persian representative at Athens.

ZEPPELIN'S GREAT AIRSHIP DESTROYED



Count Ferdinand Zeppelin is 70 years of age, a fact that should add even more to the homage he is receiving not only from Germany but the whole world. He is without doubt the only man the world has ever known to take such an active part in aerial navigation at such an advanced age. But for a still greater reason should America, next to Germany, take the greatest interest in his work, for Count Zeppelin is a veteran of the American Civil war.

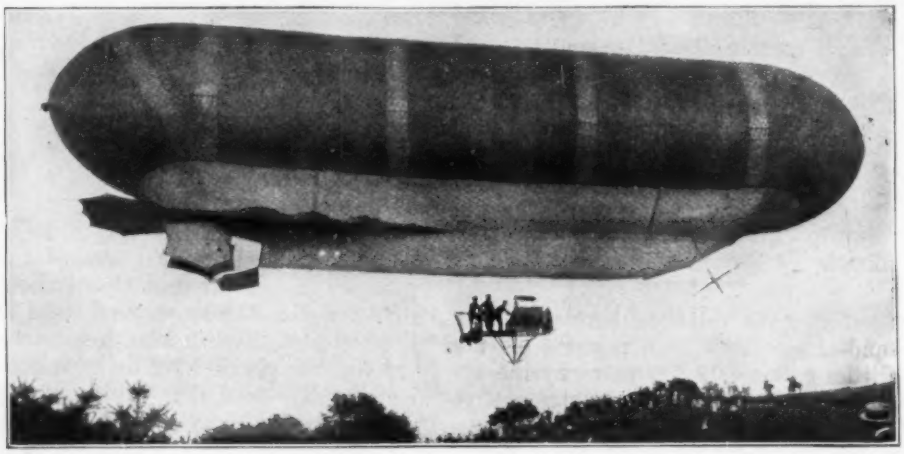
He served through the entire rebellion as a cavalry officer on the Union side, becoming an intimate friend of Carl Schurz. His first balloon ascension was made to reconnoiter the position of Confederate troops. He returned to Germany in time to participate in the Austro-Prussian war of 1866, and also in the war with France in 1870. The Zeppelins are one of the oldest aristocratic families in Germany, and have always been fighters. It was not until 1891, when the Count retired from the German army with the rank of general of cavalry, that he began seriously to devote himself to aerial navigation.

Ever since Germany forged to the front in the international battle for supremacy of the air and Count Zeppelin's dirigible balloon proved itself the greatest airship of its kind in existence, the German people have been aeronautically crazy—now they are aeronautically mad. So incensed are they, in fact,

The Wreck of the Zeppelin Airship Gives a Good Idea of Its Immense Size

with the elements which interfered with and totally wrecked the big dirigible at the moment of its greatest triumph, that all of Germany has opened its treasure chests and Count Zeppelin is assured enough funds to build not only one, but two or three new airships, if more accidents make such a contingency necessary.

The humblest German subject has become as wildly enthusiastic as the aeronautic scientists whose dreams are nightly punctured with visions of existing conditions revolutionized by their success; a state of popular feeling which has not yet struck the public in America.



The Rebuilt British Army Airship "Nulli Secundus"

Count Zeppelin's airship came to grief only after a splendid flight. He started his journey at 6:45 a. m. on a Tuesday morning, descended at Oppenheim at 6 o'clock in the evening of the same day, resumed his journey at 10:30, and reached Stuttgart at 6:15 on the following morning. Eventually the airship came to the ground at Echterdingen and at about 3 o'clock in the afternoon a violent storm came up. The airship was torn from its moorings and drifted toward the northwest. Flames burst from the rear end of the huge gas envelop and a tremendous explosion occurred. The illustration shows the extent of the wreck. Over 450 miles were covered during the day and a half of flights.

BRITISH ARMY AIRSHIP RECONSTRUCTED

The new dirigible airship of the British army, the balloon part of which is the old "Nulli Secundus," was recently tried out in a successful flight. The construction work along the bottom of the gas bag and the arrangement of the rudders are entirely new. The addition of the new part, which greatly resembles the keel of a ship, is expected to be a great aid in flying against the wind, as it has a tendency to cut through the air like a knife and to increase the efficiency of the rudders, which it also protects.

WINS AMERICAN AEROPLANE TROPHY

In the first official aeroplane test ever made in the United States G. H. Curtiss, in the "June Bug," won the Scientific American trophy, covering the required distance of 3,280 ft. in 1 min. 15 sec. Although this distance was all that was necessary to win the trophy the "June Bug" continued its flight 1,800 ft. further, making a total distance of only 200 ft. less than a mile.

BATTLESHIPS OF THE FUTURE TO BE PROPELLED BY GAS ENGINES

Great Advancement in Gas Engine Construction--Huge Freighter on Great Lakes to be Equipped with 2,000-Hp. Gas Engine--U. S. Geological Survey Finds What Has Been Considered Waste Product Excellent as Gas Producer

By John L. Cochrane, United States Geological Survey

The prediction is made by Robert Heywood Fernald, a mechanical engineer who has for several years been connected with the fuel investigations of the United States Geological Survey, that the war vessel of the future will be a swift, smokeless, noiseless craft, lying low in the water, with every vulnerable part below the water line, the entire deck being given over to the work of the guns. There will be no smoke, because the vessels will be propelled by gas engines, and at night there will be nothing to betray the presence of one enemy to another. Mr. Fernald believes the gas engine, or internal combustion engine, as it is called by engineers, will be installed in the ships of the U. S. navy within a few years.

"I expect to see the United States ahead of every other nation in this innovation," said Mr. Fernald. "The gas engine, in my opinion, is feasible on any vessel because of its economy over the steam engine, but it is especially desirable on the fighting ship for the reason that it makes no smoke. The gas is generated in a producer which has no chimney and needs none. The coal is turned directly into gas which goes straight to the engine.

"The smoke nuisance has been a serious problem to the navies of the world for a number of years. In the day time, the presence of an enemy's ship has been discovered miles away by the smoke from its stacks and in the night the flames belching from the tops of the stacks have spoiled many a well laid plan of attack.

"The elimination of the smoke is sufficient to call for the installation of the gas engine, yet there are many other features in its favor. The vessel would have a free deck for the play of its big guns. There would be no towering stacks to puncture or destroy, perhaps crippling the boat. It would be unnecessary to carry as much coal, for the same power can be developed with one-third less than the steam engine uses. The gas producer and the gas engine would take up less room and weigh less than the same power Scotch boiler and steam engine. If it were necessary it would be possible to carry more coal, which would give the vessel a radius of travel far greater than at present.

"Of course, I do not expect to see the gas engine confined to the use of the navy. The fact that it shows such economies will compel its installation in all sorts of vessels. One of the big items of expense to a modern ocean liner is its coal bill. These vessels will consume 10,000 tons of high grade coal on a round trip. With the gas engine this could be reduced to 6,000 or 7,000 tons, a saving of several thousand dollars. Then what a boon it would be to the citizens of New York, Philadelphia, Boston and other seaports to have all the vessels entering equipped with smokeless engines. In New York harbor a considerable percentage of the smoke comes from the river craft.

"One of the big steamship companies of the Great Lakes is about to take the initiative in this movement. Plans have been made for a freighter that will use a 2,000-hp. gas engine. This company is not making the experiment because of the smoke from the stacks of its vessels, but in order to demonstrate the economy of the gas engine over the steam engine. At present this concern is paying $3 a ton for coal, and its managers figure a considerable saving if the gas engine proves a success in marine work, and I see no reason why it shouldn't. Already

the marine type of gas engine has been designed up to 2,000-hp. The future will see much larger units."

The government, through the United States Geological Survey, has been experimenting with the gas producer and gas engine for several years and has demonstrated that this type of engine in a stationary plant is capable of generating from twice to three times as much power from a given amount of coal as the steam engine. It has also shown that the gas engine can develop more power from a low grade coal such as the lignite of North Dakota than the steam engine can with the same weight of the best bituminous coal.

The purpose of the Government has not been to develop the gas engine, but to increase the efficiency in the utilization of the coal supply of the country, which is now being used at an enormous rate. Experts declare that if the present increase in consumption keeps up the better part of the coal will be gone before the close of the next century and that the nation will long before that feel the effects of the waning supply. The Government itself spends $10,000,000 yearly for coal and it was primarily to get the best results from this expenditure that the investigation of the gas producer and gas engine was taken up.

The tests in the gas producer at the Government plant have shown that many fuels of such low grade as to be practically valueless for steam furnace purposes, including slack coal, bone coal and lignite, may be economically converted into producer gas and may thus generate sufficient gas power to render them of high commercial value. In this way, lignite beds underlying from 20,000,000 to 30,000,000 acres of public lands, heretofore supposed to have little or no commercial value, are shown to have a large value for power development. This is of importance to the West and makes possible a great industrial development there.

COMBINED FENCE AND SPRINKLING SYSTEM

A substantial fence and a water sprinkling system are neatly combined in this illustration. The fence railing is composed of a 1¼-in. water pipe, run through 6 by 6 in. posts, placed a few feet apart. Valves are provided at intervals of 50 ft. and hose attached.

DROP A DIME AND GET A TYPEWRITER

An enterprising typewriter firm is making arrangements to supply hotels with machines whereby the guests, by depositing a dime in an attachment placed on the typewriter, may have the use of it for a half hour. The machines will be provided the guests either in

"The Fence Railing is Composed of Water Pipe"

the main writing rooms of the hotels or in their own rooms. Such an arrangement will make it unnecessary for commercial men or others to carry typewriters along with them. Plans are also being made to equip steamers and Pullman cars in the same way.

GASOLINE LAWN MOWER

This type of gasoline-propelled lawn mower is being used to some extent in Detroit, Mich. Inventive genius has come to the long-suffering caretaker, as it has come to the aid of man in all other kinds of labor, and if he is strictly up-to-date in the matter of equipment he starts the motor, mounts the seat of

An Easy Job

the mower and lets the engine do the rest, taking life easy beneath the shade of a capacious umbrella.

AMUSEMENT WHEEL TURNED BY FALL OF WATER

This miniature Ferris wheel is operated by a fall of water, on the same principle as the old overshot millwheels of years ago. The water is pumped to

Located at Waterloo, Iowa

the top by an electric motor and runs down the outside of the wheel. The cars, 12 in number, are attached to a framework inside the rim. The adaptation of the overshot millwheel principle for such a purpose has created great interest among amusement seekers at the park in Waterloo, Iowa, where the wheel is located.

CUTTING LAVA INTO BLOCKS

The lava found near extinct volcanoes in California is often used as a material for mantels and fireplaces. It is light in weight and of numerous shades. The blocks are sawed into shape with a common handsaw and then trimmed with chisels, which is not difficult, as the lava cuts easily.

MICROSCOPE FOR STUDYING INSECTS IN NATURAL SURROUNDINGS

By means of a novel instrument, devised by a French naturalist, it is now possible to study the life and habits

1—Using Vitascope Outdoors
2—Spider Attacking Fly; as Magnified
3—Indoor Study

of the small denizens of the animal kingdom in their natural surroundings.

The device is known as the "vitascope," and is a kind of close-range telescope by means of which the observer has no necessity to approach closer than 3 or 4 ft. to the object. By suitable facilities the object glass may be brought as close as 5 in. to the creatures without the latter being aware of the fact, while ordinary daylight is quite sufficient for the examination, and the object has neither to be removed from its surroundings nor touched. Consequently the most timid of small life can be observed at ease and be perfectly ignorant of the fact that it is under survey.

The instrument has a magnifying power that enables it to magnify an object from 144 times to 3,600 times its natural size, according to the distance from it. Consequently its slightest movement and the most minute detail of its anatomy can be studied. It can also be applied to indoor study for the examination of live objects in captivity or as a microscope in the investigation of mounted specimens.

The apparatus possesses, in fact, all the advantages that the microscope lacks. With the microscope the object under scrutiny has to be placed on the instrument and under a strong light and the lens brought very close. With the vitascope all the beauty of coloring and minute detail is revealed immediately. Such delicate operations as the bee collecting honey, the attack of the rosebud by the aphis, a spider spinning its web or devouring its prey, the whole life-history of the silkworm from the first breaking of the egg to the birth of the moth, and its subsequent existence, may be followed.

AN APARTMENT-HOUSE MAIL CHUTE

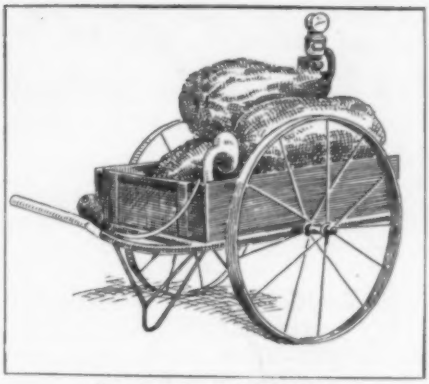
A number of apartment houses in New York have been equipped with a device for handling mail which makes it impossible for others than those in the apartment for which the mail is destined to get it.

On the ground floor is a mail box which can only be opened by the postman. This box contains a number of smaller metal boxes carried in a frame. The framework moves from the first floor to the top floor in a chute, and as it passes the upper floors the boxes destined for the different apartments are detached and automatically dump their

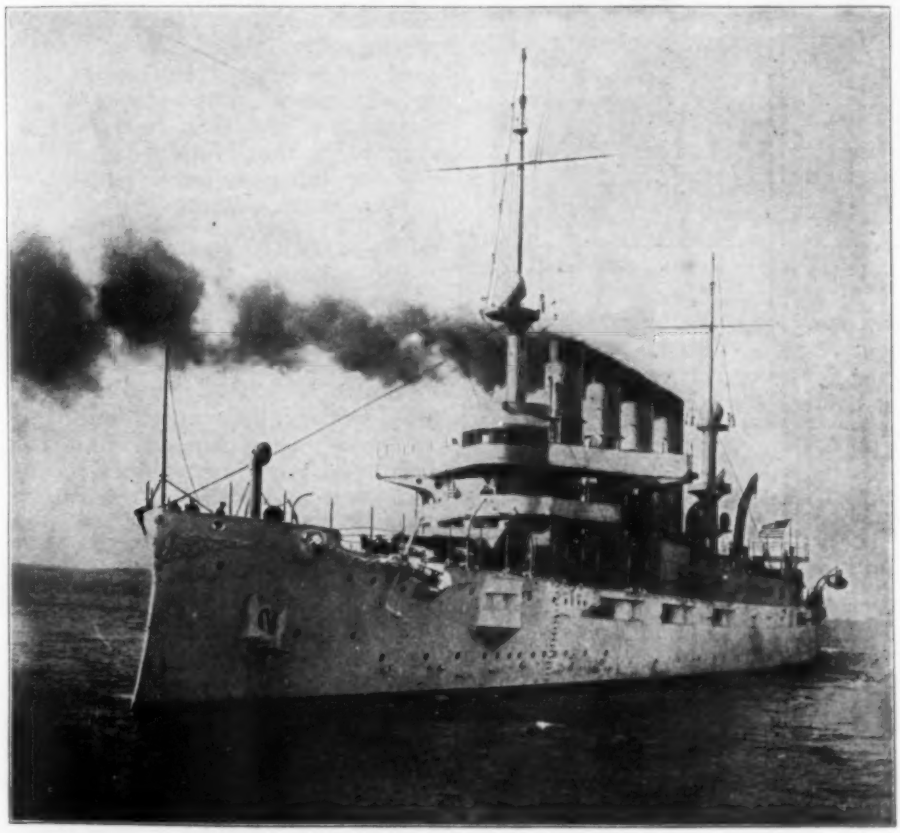
contents into mail boxes imbedded in the walls. The doors of these boxes open directly into the apartments. when the carrier reaches the roof it automatically returns, picks up each of the little carriers and returns them to the ground floor. It is operated by an electric motor and cable attachment.

TIMING THE OFFICE BOY BY AUTOMETER

After years of experience with the average office boy, a firm in Beloit, Wis., has hit upon a scheme by which it has successfully tamed that disciple of the "easy life." He no longer tarries by the wayside, but pushes a mail cart equipped with an autometer and odometer combined. The combination registers the speed with which he is traveling and how far he has been when he gets back, thus the office manager pretty nearly knows just where he has been when he returns. It is now claimed



No Loafing with This Cart

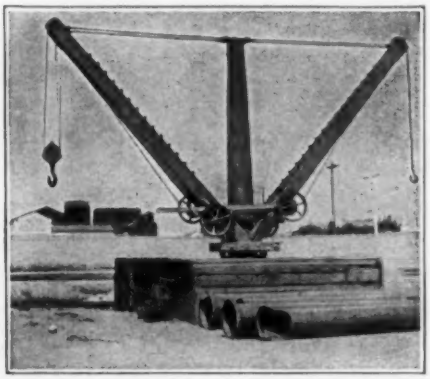


U. S. S. "Montana," Just Gone Into Commission

that the boy has become greatly interested and takes infinite pleasure in trying to make record runs. The cart is also equipped with an automobile horn so that he can amuse himself by making noise.

A DOUBLE FREIGHT-YARD CRANE

This double freight-yard crane has a heavy double tackle on one side and a lighter one on the other. When the crane on one side is delivering a load on a car the opposite crane can be picking up another load, or when an



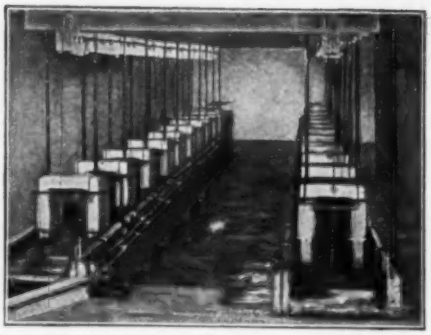
Loads and Unloads at Same Time

extra heavy load is being carried by the larger crane, a counterweight attached to the lighter one increases its capacity and lightens the strain on the central support.

AN ELECTROLYTIC SEPTIC TANK

The new electrolytic septic tank just installed at Santa Monica, Cal., to kill the germs of animal and vegetable life in sewerage is claimed to be entirely successful and only costs 50 cents per day to operate.

The tank consists of a pair of concrete chambers arranged parallel to each other. In these chambers are two sets of electrodes of 10 units each, charged with a strong current at a low



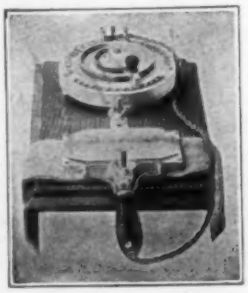
Costs 50 Cents a Day to Operate

voltage. The sewerage enters at the upper end of the chambers and in passing between the electrodes all traces of animal and vegetable life are destroyed. The sewerage issues from the lower end almost clear, in which condition it is emptied into the ocean 200 ft. from shore.

The entire system, except the large receiving tank, is contained in a reinforced concrete room built below the level of the street. The sewerage is first received in a large tank, from which it is pumped to the purification chambers in such quantities as can be handled.

AN ELECTRIC VULCANIZER FOR REPAIRING AUTOMOBILE TIRES

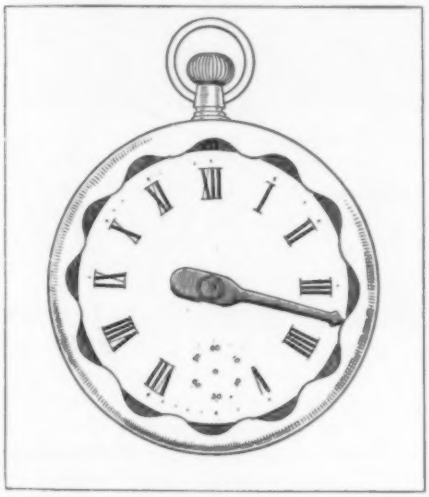
Many a cut or fractured automobile tire can be repaired so it will give continued service if a vulcanizer is at hand and can be used in repairing. Various kinds of vulcanizers have been in use for the purpose of placing new rubber into cuts, breaks or burst casings. Heat must be applied to vulcanize the crude rubber into wearing qualities. Gas heat as well as steam has been used for this purpose. Now comes the electric vulcanizer. All that is necessary in mak-



ing a repair is to turn the plug into a nearby electric socket and apply the device, which is then ready for use. The heat is automatic and does not require watching. The accompanying illustration shows the application of the electric vulcanizer on an inner tube. The vulcanizers are made in different styles and sizes to suit the automobile owner, repairman or garage, and the heat, being regulated, requires less skill in handling.

INEXPENSIVE WATCH FOR THE BLIND

The blind usually have poverty with them and cannot afford as expensive articles as their better-equipped brothers. This watch can be bought and the



Costs $1.35

necessary change made to its exterior for $1.35. The watch itself is one of the dollar type, bought for 90 cents. To convert such a watch into a timepiece with which the blind can ascertain the time, take off the crystal and rim holding same, and on to this rim solder a scalloped flange, having twelve scallops, as shown in the illustration. Take off the hands, replace with a heavy hour hand, and cover the whole with an outside case or watch protector, and the transformation is complete. An outside case can be bought for 35 cents, and the hand and scalloped flange will not cost over 10 cents more.

HUGE WATER TANK 220 FEET HIGH

The water tank of the Louisville, Ky., water system has a capacity of 1,200,000 gal. of water, which is equal

Capacity, 1,200,000 Gallons

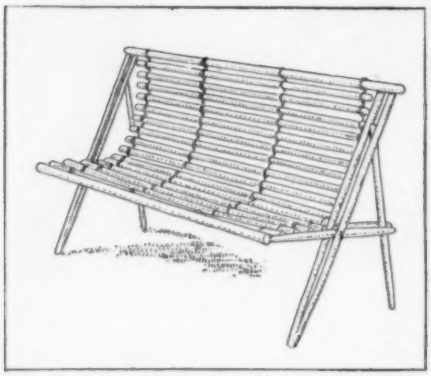
to a load of 10,000,000 lb. It consists of a cylindrical steel tank 50 ft. in diameter, 65 ft. high, with a hemispherical bottom 24 ft. 11¼ in. deep, and a conical roof 18 ft. 9 in. high. It is supported at a height of 155 ft. by eight riveted steel columns. A verti-

cal riveted steel pipe 50 in. in diameter extends from the center of the bottom of the tank to the regular water mains 12 ft. below the ground.

When water is wanted at an elevation of 50 ft. or less it is entirely a matter of personal choice whether it shall be stored in an elevated tank or in a standpipe. At an elevation of 100 ft., however, the standpipe would cost twice as much as an elevated tank, at 200 ft. four times as much, and at 300 ft. six times as much.

A SIMPLE FOLDING LAWN SETTEE

This folding lawn settee can be easily constructed by anyone familiar with tools. All the wood parts are of straight



Easy to Construct

material. The strips of wood that form the seat and back are woven together by wire. The seat and back easily accommodate the lines of the body.

RESULTS OF TECHNICAL EDUCATION IN ENGINEERING PROFESSION

The president of the Michigan Engineering Society is reported to have made the statement that university presidents and professors greatly overrate the value of a technical education and that not more than half the graduates of engineering schools ever put their education to any considerable use. Also, that technical graduates who achieve fame could almost be counted on one's fingers.

As a reply to this, Prof. J. R. Allen, M. Am. Soc. M. E., prepared the following table concerning graduates in mechanical engineering from the University of Michigan, 1883 to 1897:

Position.	Number of Men.	Percentage.
Presidents of manufacturing corporations..	9	10.6
Vice-presidents or secretaries	4	4.7
General managers.....	12	14.0
Superintendents	4	4.7
Chief engineers.....	22	26.0
Consulting engineers...	11	13.0
Patent attorneys.....	3	3.5
Professors	3	3.5
Chief draftsmen, etc...	12	14.0
In other professions...	5	6.0
Total	85	100.0

CONCRETE BRIDGE FOR WATER PIPE

This narrow concrete bridge carries a cast-iron water pipe across the bed of a California river. The piers are set 20 ft. apart and are made of reinforced concrete, as are the beams and yokes. The yokes connect the beams and form a support for the pipe.

Carries Cast-Iron Pipe Across River

AN ENGLISH RAILROAD SHOP

In This Shop All the Work is Done by Hand

This illustration shows an interior view of one of the shops of the Lancashire & Yorkshire railway, England, in which passenger coaches are being constructed. The lighting arrangements are interesting, likewise the upright beams at the ends of each bench on which the workmen hang their coats and hats.

POWER OF JAPANESE NAVY TO BE DOUBLED

Japan's admiralty has decided on a large scheme of rearmament as part of the plan to extend the power of its naval forces. The armaments of all the old ships will be altered so as to bring them into line with the most modern ideas. Vessels of the "Mikasa" type, which have hitherto carried four 12-in. and fourteen 6-in. guns, will carry the same number of 12-in. guns, but four 10-in. guns will be substituted for the 6-in. batteries. This will bring their principal armament up to eight pieces of heavy caliber instead of only four.

MEXICAN BRONZE CAST WEIGHS 4 TONS

Some 20 years ago Mexico contributed many strange castings, representing the Aztec gods, to the International Fair at New Orleans. After the close of the exhibition the Mexican government ordered that the Mexican pavilion and its contents be sent to Mexico City. A fire destroyed the pavilion and nearly all its contents, but what remained was shipped to Mexico. The ship on which it was loaded, however, sunk near Vera Cruz and the cast shown in this illus-

Survived Fire and Wreck

tration and another just like it were all that were recovered. Having escaped the perils of both fire and water, they are now on exhibition outside the Mexican Military Museum. This casting weighs 4 tons.—Contributed by A. E. Arce.

FOOT-BRIDGE ON VALDEZ-FAIRBANKS TRAIL, ALASKA

Plain telephone wire suspension bridges are the only practical ones across the several streams that have

An Alaskan Bridge

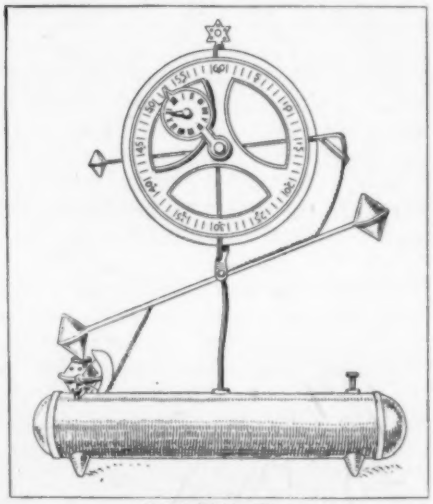
their source in the Valdez glacier, four miles back from Valdez, Alaska. This four mile stretch of country is level, and at certain seasons of the year is entirely inundated, and ordinary bridges would be washed away. This bridge is in reality a part of the Valdez-Fairbanks trail and every miner who makes the 400-mile "mush" must cross it.

Two hundred members of a summer colony near Portland, Me., recently watched an enormous 75-ft. whale thrash itself to death in the shallow water. It had followed a school of fish into the bay.

HEAT IS MOTIVE POWER OF REMARKABLE CLOCK

Of all the clocks of all the ages since the Parisian clockmakers became famous for their artifice in devising unique ways and means of telling the hour of the day none are more remarkable than the clock here described.

It is a clock operated and regulated by the constant application and withdrawal of artificial heat. Its base is a tank containing 2 qt. of alcohol. At the left end of this is a lamp. The minute dial of the clock is supported by a standard which rests upon the center of the tank, and just beneath it is a rod or balance pole, on each end of which is a hollow cone. The cone on the left end is so arranged that, when cold, it overbalances the cone on the right. The mechanism is so perfect, however, that after the exact termination of five seconds over the flame of the lamp, this cone, made lighter by the heat, ascends quickly, causing the right end of the rod to drop. Attached to the left arm of the rod is a chain which pulls the crescent-shaped cover over the lamp and shuts off the heat.



Heat Tells Time

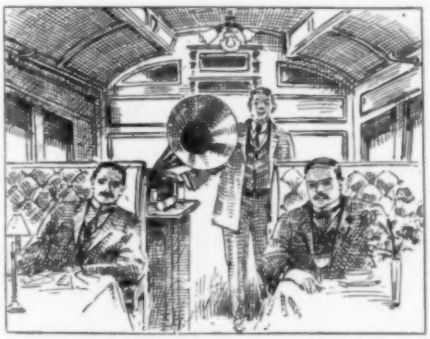
The rise of the left arm of the rod takes but one second, and at the exact termination of five more seconds the heated cone becomes sufficiently cool to

again outweigh the right end and descend into position over the lamp. This continual reciprocating movement works a chain running from the right arm of the rod to a pin attached to the large minute hand. The pull given the chain every time the right end of the rod falls moves this hand around the dial. The hour dial is on the back of the minute hand, and its small hand changes its position every hour. As shown in the illustration the time is 10:52.

Two quarts of alcohol is sufficient to keep the lamp burning one month. The disc on the left arm of the balance rod regulates or sets the movement.

GRAMOPHONES ON DINING CARS

The Great Central railway in England has introduced a new feature on their long distance trains in the form of gramophones in the dining cars. The traveler may now listen to the voices of Melba, Tetrazzini, Caruso



Condensed Music for Dining Cars

and many of the other grand opera stars while speeding to his or her destination.

A LONG DISTANCE WATER-WALKER

Probably the most successful water-walker who has ever glided along the surface of the water shod in the peculiar boat shoes which make such means of locomotion a possibility is

Travels 50 Ft. a Minute

the Mr. Oldgrive shown in this illustration. It is claimed that he has walked more than a thousand miles on the Mississippi and Ohio rivers, but this figure, of course, is a compilation of the many trips he has made of a few miles, not one steady walk.

The feature of his boat shoes are the leather pockets on the bottoms. They open and close as he walks along, thereby affording resistance on the backward stroke of the feet and enabling him to move forward at a rapid pace. It is claimed that he can travel 50 ft. a minute in still water.

COKE PRODUCTION IN UNITED STATES

The total production of coke in the United States last year amounted to 40,779,564 short tons, valued at $111,539,126, a total that passes all previous records in the history of coke manufacture in this country, being nearly double the output of 1900 and more than three times that of 1897.

The amount of coal consumed in the manufacture of this coke was 61,946,100 tons, valued at $72,784,851. This figure leaves a difference between the value of the coal and of the coke of $38,754,275, but the cost of manufacture and of administration and selling must still be deducted before the profit is arrived at

U. S. MAIL DOG TEAM IN ALASKA

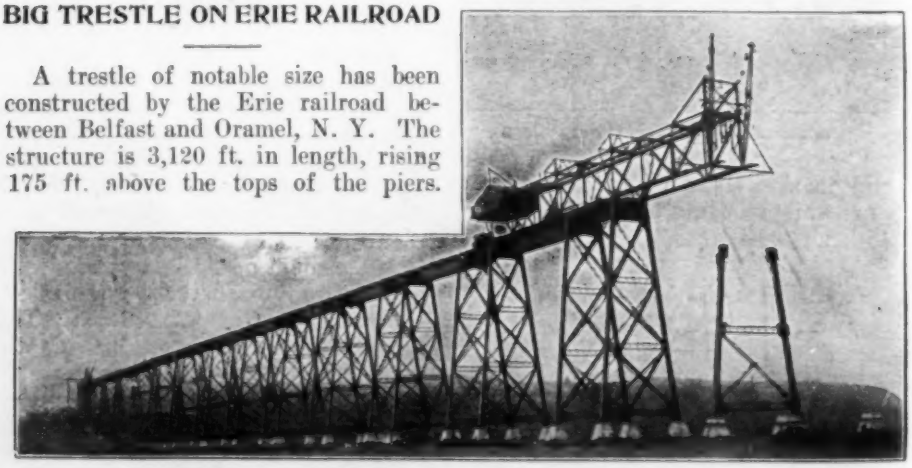
This illustration shows an Alaskan mail carrier and his dog team lined up for inspection. Eight dogs usually compose a team and they drag the sled containing the mail sacks and the two men accompanying them at a creditable speed. Practically the only means of transportation during the winter months in many parts of Alaska is by dog team.

Employes of the U. S. Postoffice Department

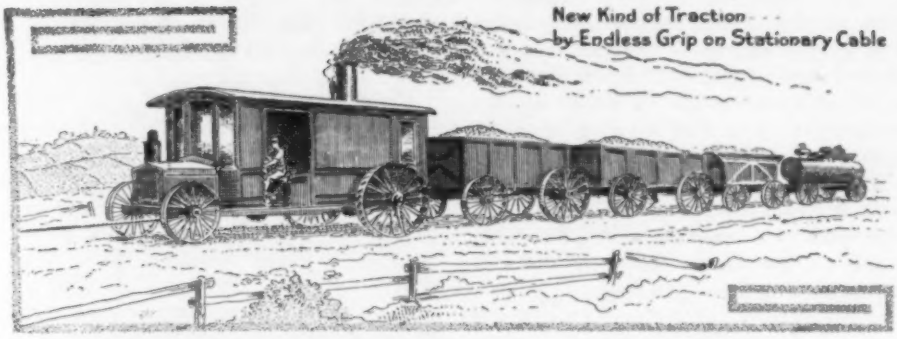
BIG TRESTLE ON ERIE RAILROAD

A trestle of notable size has been constructed by the Erie railroad between Belfast and Oramel, N. Y. The structure is 3,120 ft. in length, rising 175 ft. above the tops of the piers. There are 98 concrete abutments, the highest being 65 ft., supporting 25 towers, each of which carries two 40-ft. girders. The towers are 80 ft. apart at the tops, connected by steel plate girders. The river span consists of two girders 120 ft. in length, and two 126 ft. long, the four beams weighing 110 tons. The derrick on the traveler shown in the illustration is itself 65 ft. high, the traveler weighing 136 tons.

The government road up the rugged side of Mt. Rainier is almost completed. The first appropriation was made in 1903, and it was estimated that the total cost will reach $250,000. It will be the only government road running through a national reserve over which automobiles can pass.



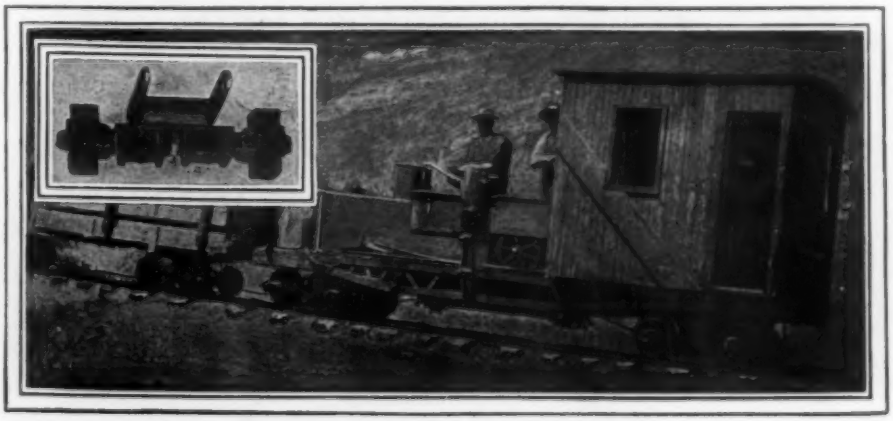
Length 3,120 Ft.—Rises 175 Ft. Above Tops of Piers



TRACKLESS CABLE FREIGHT ENGINE

It is a well-known fact that the loss of power in securing proper traction in the application of the power is the most difficult problem to solve. Many methods have been devised to overcome the losses through tractive efforts without very much success. A new style of cable railway, the recent invention of a Californian, promises to make radical changes over the old system of hauling by traction engines. Where large traction engines are used for freight their pulling power is effected by reason of their weight and the hold they have on the earth. This new system does away with the extra weight necessary for this purpose, and all the power is directly applied for the pulling. The accompanying illustration shows a traction engine weighing 8 tons with 200 hp. pulling a train of 150 tons weight. The stationary cable is the "rail" of the system. The grip device moves along this cable, and the traction is secured by mechanical clutches that grip the cable with a force that is controlled automatically by the amount of pull on the grip by the load that is being pulled. The greater the load, the tighter the grip clutches the cable.

The gripping device consists of a chain that travels over two sprocket wheels placed longitudinally of the engine truck. These sprocket wheels are driven by the motive power of the engine, whether it be steam or gasoline. Each one of the links of this chain is an independent grip, so arranged that when a link reaches a position under the forward sprocket wheel it automatically grips the cable, which has been guided into its jaws, and as the lower



part of the chain travels toward the rear of the engine it pulls on the anchored cable until it reaches the rear sprocket wheel, where it automatically releases its grip and returns over the sprockets to the forward position and repeats the operation. Thus there will be a link grabbing hold at the forward end and one letting go at the rear, while all the links between the two sprockets are firmly gripping the cable and performing the work of pulling the engine and the entire train attached along the course of the cable. The gripping device travels, while the rope is stationary. Slipping under these conditions is impossible and thus a very little, if any, power is wasted.

An unlimited amount of traction may be secured and the pulling power only limited to the horsepower of the engine. The traction is uniform for all conditions of roadbed and for all grades.

This system can also be used on rails, and its ability to cross deserts and climb the steepest grades with or without rails makes it well adapted for use in mining and lumber countries.

HOUSE TO HAVE VANISHING ROOMS

Plans have been made for the erection of a house in New York the first floor inner-walls, or partitions, of which will be made to disappear according to the amount of space required for social occasions such as receptions or other functions of a large nature. Grooves in the floor will allow all the partitions, except those forming the kitchen, to sink to the floor level, giving an unobstructed space of 80 by 120 ft. if so desired. Electricity will be the power.

PIGEON RACE FROM FRANCE TO ENGLAND

Every year a great pigeon "Derby" is flown from France to England. In this year's event 7,513 birds were conveyed from Lancashire, England, to Nantes, France, and there liberated for their long homeward flight of 450 miles. They were carried in 687 baskets, occupying 14 railway cars. The winning bird made the journey in something

"This Year 7,513 Birds Were Liberated"

less than eight hours. The illustration shows the birds being liberated at the Nantes railway station.

A FLOATING CISTERN

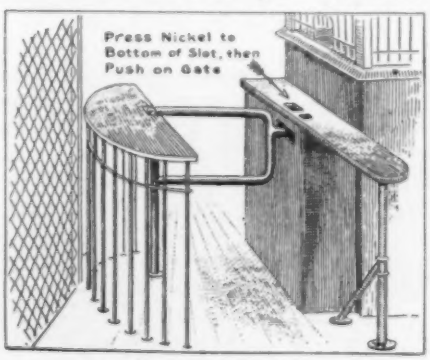
According to the contributor of this photograph, the cistern became empty, grew tired of its job, and arose out of the ground. In reality, although constructed of brick and very heavy, it was

Cistern Above Ground

forced out of the ground by water working its way under and around it without finding an entrance. It floated like a huge jug.

NICKEL-IN-SLOT TURNSTILE FOR L-ROADS

The Boston Elevated railway is experimenting with a nickel-in-slot turnstile for use in subway and elevated stations. It consists of a box 3 ft. high and 1 ft. square, attached to the turnstile. In the top of the box is a slot just large enough to receive a nickel. When the nickel is pressed to the bottom of the slot a knob on the end of a horizontal lever is released and swings away, releasing the turnstile. This returns to its position as soon as the passenger has pushed through the stile.

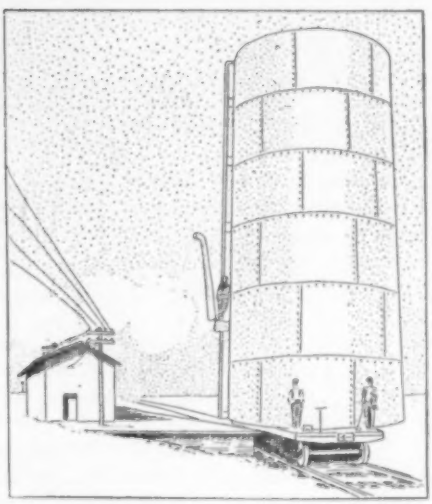


No Station Agent Required

MOVING A WATER TANK BY RAIL

A steel water tank, 24 ft. in diameter and 43 ft. high, weighing 30 tons, was successfully moved by rail from one railroad yard in Springer, N. M., to another 4 miles distant.

The structure was first moved on



Tank Loaded on Car

rollers to a cribbing on the track and then jacked up high enough to set two steel flatcars underneath. The cars carried a timber platform 24 ft. wide. The tank was chained to the car sills and braced on each side. Two curves, with an elevation of 5 in., had to be rounded, and when these were approached the side bearings were blocked with short jacks and the lower side of the cars raised. Thus the 4-mile trip was accomplished without accident.

A NEW FOUR-WHEEL DRIVE AUTOMOBILE

By Charles Alma Byers

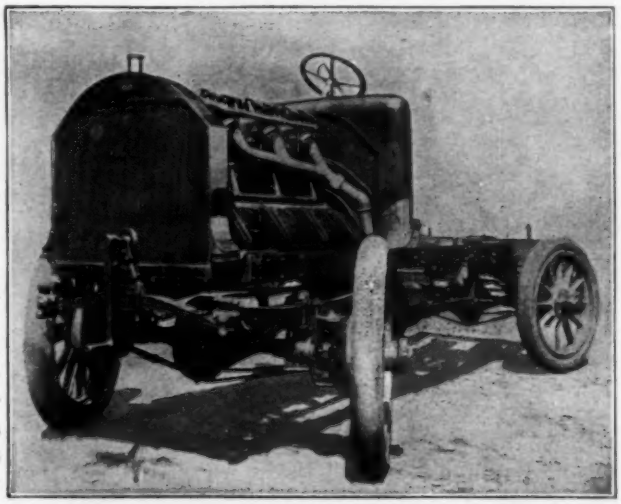
M. H. Magie has designed an automobile of new pattern that is steered, driven and braked on all four wheels, and has, in addition, a new style transmission gearing. The first automobile of such design has just been completed, and a test run of 150 miles has seemed to prove it a perfect success.

The application of power to all four wheels, instead of two, comprises the car's most interesting feature. The transmission gearbox is located in the middle of the chassis, and the power shaft from the engine centers in the ordinary manner. Two driving shafts, one to each axle, issue from below the power shaft and terminate in the usual differential. The live axles communicate their power to the road wheels through universal joints of special design, which embrace the use of four-point ball bearings for the support of the steering knuckle. This arrangement transmits power to all four wheels at whatever angle they may be. Only one motor is used, which eliminates the difficulty of synchronizing two motors, experienced in former attempts at building a four-wheel drive, notably that of Walter Christie, and as each axle has its own differential, the power at each wheel is equal.

The power shaft carries four gears, which are connected to the lay shaft by silent chains running to four other gears cut in proper ratio. All gears and chains are constantly running. The desired speed is obtained by clutching the proper gear wheel on the lay shaft to the shaft by a dental clutch.

The brake rod runs directly above the universal joint of the driving axle, which has its own universal joint centered over the power shaft, enabling the application of the brakes at whatever the angle the wheels may be.

The steering gear is of the usual type. From the forward right wheel arm there runs a rod to the back left wheel arm—thus when the front wheels are put over one way, the rear wheels are put over the other way. This enables the turning of the car in an angle of about 50 degrees, as against the usual limit of 35 degrees.



Steered, Driven and Braked on All Four Wheels

The advantages of the four-wheel drive, brake and steer are full traction, more perfect control, less tendency to skidding, greater speed and greater efficiency.

FOUGHT FOR BUT CANNOT SAIL UNDER U. S. FLAG

The United States navy transport "Zafiro," although a gallant little actor in the American assault on Manila, cannot engage in peaceful pursuits under the flag of the United States, owing to the peculiar nature of the American marine laws. The little vessel was purchased by Admiral Dewey for transport services and later took part in the bombardment of Manila, where her machine guns played havoc with the Spanish garrison.

Recently the vessel was offered for sale by the United States government, but no purchaser could be found because, having been of English registry when Admiral Dewey purchased her, she cannot even now be admitted to American registry.

This is only one illustration of why 90 per cent of America's boasted $3,000,000,000 foreign commerce is carried by foreign ships.

SANITARY DRINKING CUP

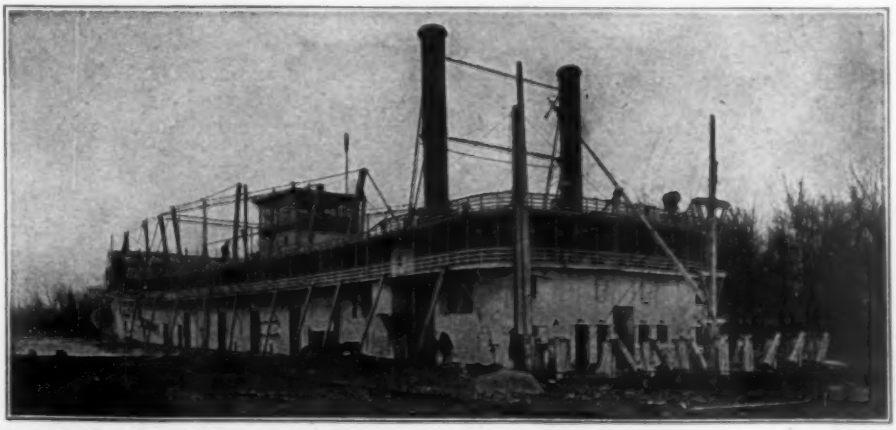
A sanitary drinking fountain of recent invention is now rapidly replacing the old style cup method which has for scores of years held sway at public drinking places. Here is a photograph of one of the new style germ proof public drinking fountains which has the indorsement of the medical fraternity. A number of cups are arranged stationary within a large bowl. Each cup receives a continuous water supply from a small pipe entering at its base through which flows a constant stream of water overflowing the cup and filling the large bowl. To obtain a drink it is only necessary to stoop and bring one's lips in contact with the flowing water.

Germless Drinking Fountain

HUGE MISSISSIPPI RIVER TOWBOAT

The fact that the vessels used on the Mississippi today are almost identically the same as the type of vessels in use 30 years ago has led many people to the conclusion that construction in the Mississippi valley has stood still, but such a belief is highly erroneous. It is true that the vessels today are of the same squat type, but this is the fault of the river, not a lack of genius on the part of its shipbuilders.

In no other way has shipbuilding stood still, as is aptly demonstrated by this illustration of a mammoth towboat. It is constructed almost entirely of steel, and a close scrutiny of the illustration will show two powerful electric searchlights on its upper deck. The boat is three times as large as the

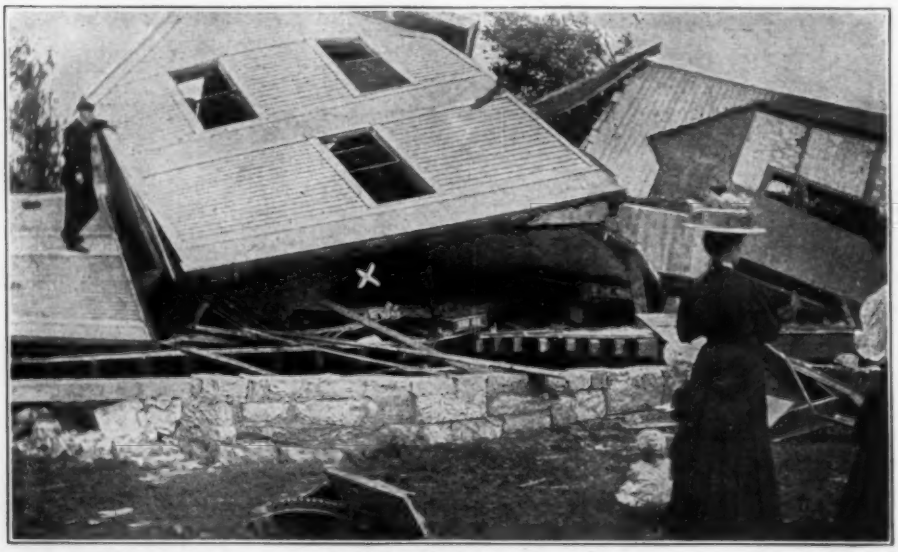


Constructed Almost Entirely of Steel

ordinary type of Mississippi tow-boats and is capable of hauling four times as heavy a tow as its nearest competitor. She tows coal barges, coming from the upper Ohio, to the Gulf of Mexico for foreign transportation. A single fleet of these scows actually covers many acres and contains thousands of tons of coal.

HOUSE WRECKED BY CYCLONE

The cause of this wreck was a cyclone which swept over Charles City, Iowa. The cross shows the place where an old lady and her two sons crawled out from under the wrecked house after the storm had passed.—Photo by R. W. Jennish.



After the Storm Had Passed

RECORD BREAKING PASSENGER TRAIN RUN

A passenger train, composed of two 60-ft. baggage cars and two sleepers, recently carried a theatrical company from Pittsburg to Chicago in 7 hr. 42 min. The distance covered was 468 miles, so that the average speed was a fraction less than 61 miles an hour, including stops. The special was stopped four times and slowed down once by the block signals to prevent overrunning the Pennsylvania's 18-hour flyer. One of the forced stops was five minutes and the others were nearly as long.

It is claimed that never before has such a high average speed been maintained for so great a distance by a passenger train.

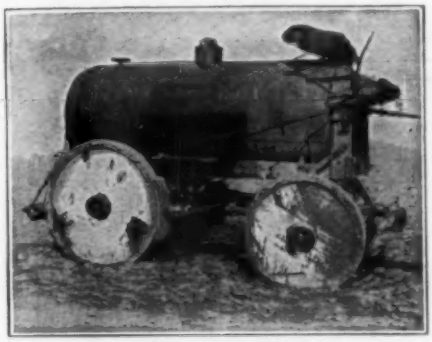
VAST ELECTRIC PROJECT IN BAVARIA

The Bavarian government is proposing to operate all of the state railways by electrical energy generated by water-power development. The first installment of funds for the electrification of three lines near the Bavarian and Austrian frontier will be provided for in the budget for 1908-09.

A report issued by the government estimates the minimum amount of power capable of being supplied by different watercourses at 300,000 hp. To this amount must be added the much greater supply which could be obtained from lakes that might serve as reservoirs. The estimated cost of electrifying the three lines above proposed is between $7,000,000 and $9,000,000.

PROTECTING THE WHEELS OF OIL SPRINKLERS

A large number of California roads are made by sprinkling crude oil on the surface, and either letting it sink into the dusty top layers of earth of its own accord or working it in by the aid of cultivators and harrows. Circular sheets of galvanized iron are

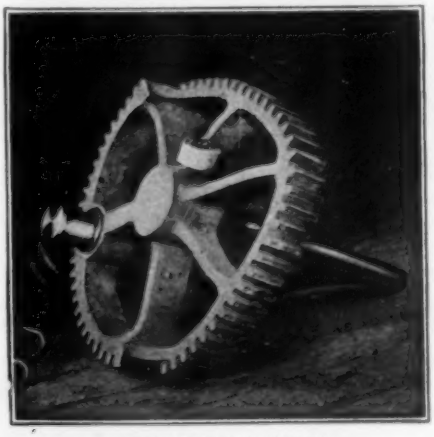


An Oil Sprinkler

bolted on each side of the wheels of the oil-sprinkling wagons to protect the spokes from the sticky earth, which would otherwise load the wheels with hundreds of pounds weight.

ODD-SHAPED GEAR WHEEL

This oddly shaped gear wheel is not as misshapen as it appears, but perfectly molded to do the work required of it. It is used on a standard pump



Freak-Shaped Wheel

and its shape gives the plunger a slow up-stroke and a quick down, or return stroke. It prevents jar and noise and saves power.

POPCORN AND PEANUT AUTOMOBILE

Whoever gazes upon this photograph will no longer doubt the rapid progress of the world in the mechanical. It seems a far cry from the long familiar popcorn push-cart to this handsomely equipped and practical popcorn and peanut automobile, but they are being manufactured, and without doubt the venders who use them will be generously patronized.

The machine is equipped with an 18-hp. engine, weighs 1,700 lb., and has a speed of 18 miles an hour. The auto-

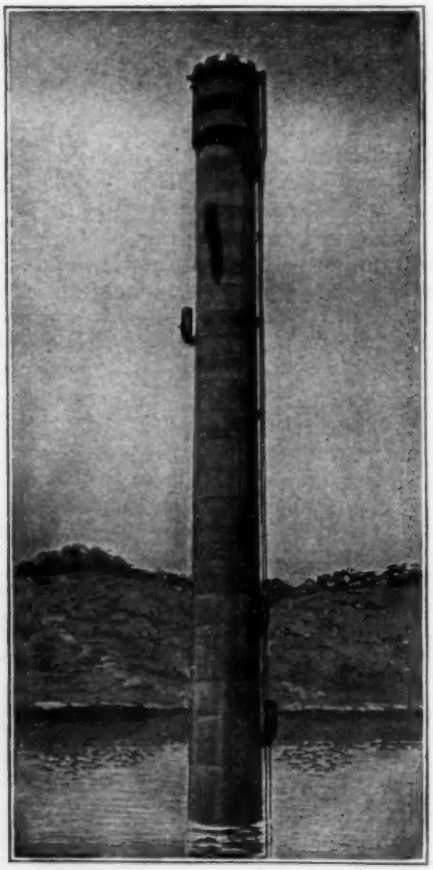
Popcorn Automobile

matic poppers, roasters and the fan in the roof are run by a hot-air engine. The hot water from the engine heats the popcorn and peanut cases.

SUBMERGED WATER TOWER

This unusual water tower is built entirely of reinforced concrete, is 185 ft. high and 13 ft. in diameter, and stands on a base in the center of an artificial lake in Little Bear valley, California, 6,000 ft. above sea level.

The tower has just been completed



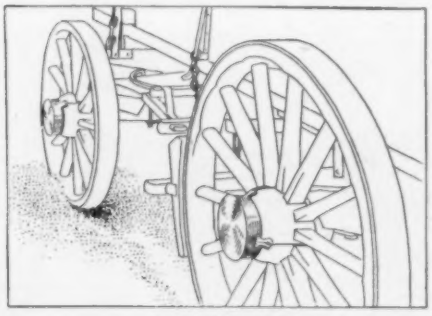
Tower Will Be Submerged

by the Arrowhead Reservoir and Power Company, which for 12 years has had its great dam in course of construction to hold back the water of an 880-acre artificial lake. The tower was found necessary because the suction was so great at the intake that it was almost impossible to keep it clear of rubbish. It is constructed with a series of 20-in. valves, running in spiral from the top to the bottom, so that the water may be taken in at any level. The intake valves at the bottom are controlled from the top. The tower complete cost the company $40,000.

The great dam will be 200 ft. high when complete, which will require 3 years more of work, making the total time consumed in its construction 15 years. The tower was constructed at low water. When the water is high it is almost totally submerged.

PROTECTING AXLE BOXES FROM SAND

Sand, sifting into the axle boxes of a wagon, causes serious friction as well as wear. Caps made of galvanized iron



A Useful Kink

fastened over the ends of the hubs keep the sand out. The caps are held in position by riveting ears (the kind used on kettles to hold the handle) to the caps and running wire through to one of the spokes.

A LIGHTNING PHOTOGRAPH

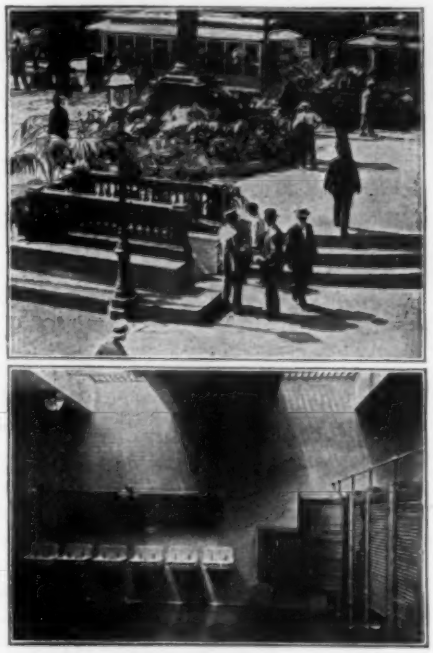
The photograph of a ribbon lightning flash was taken at 8 o'clock in the evening while an electrical storm was tear-

An Unusual Picture

ing things loose at Hartford, Conn. This flash struck an elm tree about 400 yd. distant from the camera.—Photograph taken by B. Beller.

PUBLIC REST STATION UNDERGROUND

One of the finest public rest stations in the country has recently been completed under Fountain square in Cincinnati. It was constructed of concrete at a cost of $25,000 and is entirely underground.



Exterior and Interior Views

Ventilation is secured by means of two electric motors, one of which forces fresh air into the apartments while the other sucks out the impure air. The concrete construction work is entirely hidden by white tiling on the interior and the floors are covered with English red tile. The station is divided into two departments. The women's department contains a rest room and a woman nurse who has a miniature doctor's office equipment at hand. Three attendants are present at the station constantly.

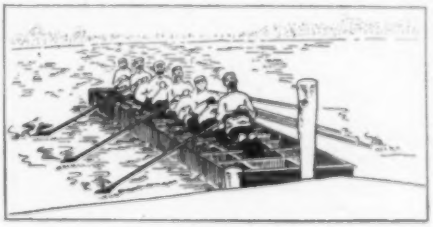
Courtesy, The Graphic

DRIFTING SEAWARD IN A BALLOON

This illustration depicts one of the many perils which make ballooning a dangerous as well as fascinating sport. The wind is carrying the party out to sea and something is wrong with the valve. The only way to descend is to get the valve open, thus allowing the gas to escape.

ROWING IN A BOAT THAT DOES NOT MOVE

A German rowing club in training its men keeps them rowing in a boat that does not move. The curious craft is made fast to a dock and the men pull as if their very life depended upon their ability to tear the dock away,



This Boat Does Not Move

much to the amusement of spectators. This exercise develops much more muscle than could possibly be obtained by the same amount of work in a light racing shell.

CONCRETE TRUSSES FOR BUILDING CONSTRUCTION

In this Los Angeles, Cal., building, constructed entirely of concrete, is embodied a new idea, in this country at least, in concrete trusses. The walls were built just as any other concrete walls, but the 16 trusses, 8 to each floor, were made in forms on the ground instead of forms supported in position by false work.

Concrete Trusses Made on the Surface

The trusses, made by what is called the Visintini process, are 37 in. high and 18 in. wide for the first floor, and 14 in. wide for the second, reinforced with six 1¼-in. square twisted bars in the first floor and four 1⅛-in. bars in the second floor, with a small amount of steel in the diagonals. The first floor beams have a weight of 19,800 lb. and the second-story beams 14,600 lb. The first truss was lifted into place just one week after being cast, and two of the trusses were placed in position after being cast only three and one-half days.

The building itself was constructed in five weeks. The only wood used is for doors and windows. The walls are plain and the only ornamentation is the concave line designs and the formade copings between the doors, but the building stands like one of the most carefully sawed white sandstone. This effect is produced by a skin coat of white cement.

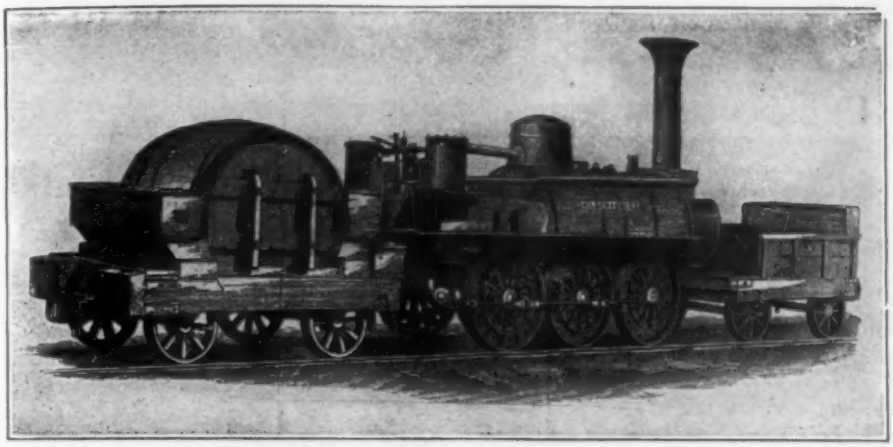
THE POWER OF BROOMS

The energy expended in one Saturday's household sweeping in the United States is sufficient, if it could be applied, to stem the torrent of Niagara Falls, according to one statistician. A pound a stroke and three strokes to the square foot gives over a ton's pressure to the floors of a 5-room house, or more than 15,000,000 tons to the aggregate number of households in the United States for one day's sweeping.

The number of brooms and brushes annually manufactured in the United States are worth $20,000,000. Four brooms a year to the average family means $15,000,000 spent every 12 months by the American people. Placed end to end the broom handles of the United States would reach one and a half times around the world, and 100,000,000 lb. of broom corn is raised in the United States each year, the value of which is nearly $4,000,000.

Every well regulated household has at least four brooms.

A QUAINT OLD ENGLISH LOCOMOTIVE



In 1830 the Fireman Worked in the Front Tender

The rear tender of this ancient locomotive suggests something very German, but was never used to hold anything stronger than water. The coal tender in front and the water tender in the rear seems an extraordinary arrangement. The locomotive is one of the earliest types and was built for the Stockton and Darlington railway in 1830.

A WHALE SKELETON AND ITS HOUSE

The skeleton of a whale and its house shown in this illustration was being moved from one part of a park to another at Long Beach, Cal., when caught by the photographer. The whale is 68 ft. long and the diameter of the vertebræ of its spinal column at a point about 10 ft. from the end of its tail is 12 in. The greatest strength is needed at that point for swimming or diving, as the tail of a whale has a horizontal instead of a vertical position, unlike most of the fish tribe. The jaw bones are 16 ft. long.

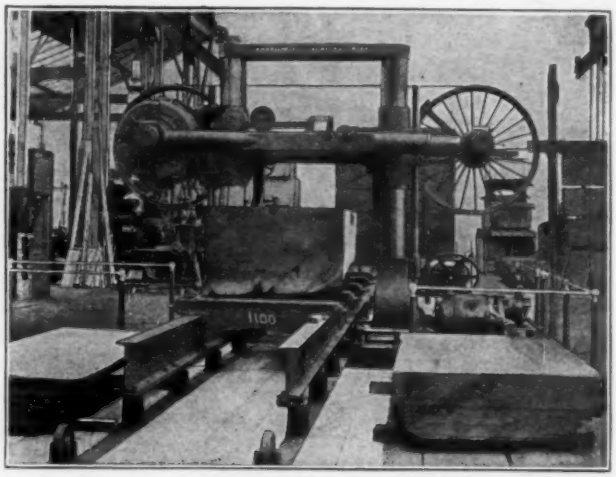
Moving a Building to Move a Whale

HORIZONTAL BAND SAW

Several of the machines like illustration have been built in England and are said to save power as well as produce a larger amount of board measure than the ordinary method of sawing.

The block of wood shown was a piece of very old elm about 4 ft. diameter, which was sawn into 1-in. boards, making 1,176 ft.; the average cutting was 81 ft. a minute. The elm was 200 years old and very hard. A veneer ¼-in. thick, 4 ft. wide and 7 ft. long was also cut.

The trial, which included some 200-year old oak, lasted 2½ hours, the cost of operation including power, labor and depreciation was estimated at $1.76, while the increased product which ordinarily would have been wasted in sawdust amounted to $11.60. Machine was run by an electric motor.



English Horizontal Band Saw

HUGE DRUM WAS ONCE FIRE ALARM

The most cherished relic of the Cincinnati fire department is a huge steel drum used by the department over 100 years ago to sound the alarm of fire. It was centrally located in the business district and vigorously beaten with the big drum stick when a fire was discovered. The fire brigade was then composed of volunteers.

Fire Alarm Relic

THE DEW-PONDS OF THE ANCIENTS

One of the prehistoric methods used in securing a water supply in sections where it was impossible to secure it from natural sources or where it became necessary to live on elevated territory for defense, was by the construction of dew-ponds.

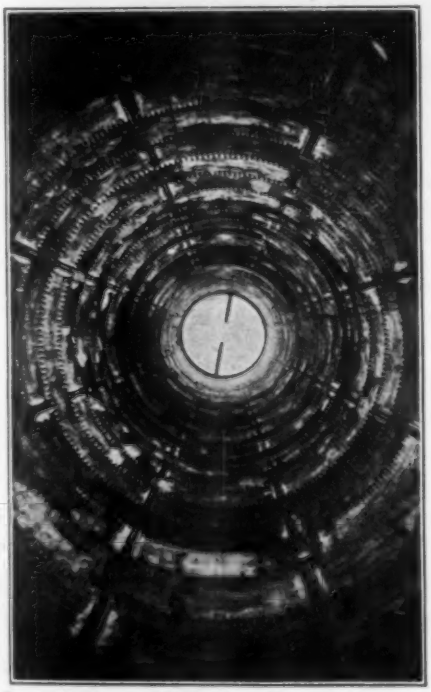
These dew-ponds were made by hollowing out the earth for a space far in excess of the apparent requirements of such a pond, then thickly covering the whole of the hollow with a coating of straw. The straw in its turn was covered by a layer of well-chosen, finely puddled clay, and the upper surface of the clay closely strewn with stones.

Such a pond will gradually become filled with water, the more rapidly the larger it is, even though no rain may fall. During the warmth of a summer day the earth will store a considerable amount of heat, while the pond, protected from the heat by the non-conductivity of the straw, is at the same time chilled by the process of evaporation from the puddled clay. The conse-

quence is that during the night the moisture of the comparatively warm air is condensed on the surface of the cold clay. As the condensation during the night is in excess of the evaporation during the day, the pond becomes, night by night, gradually filled.

In experimenting it is found that such a pond will constantly yield a supply of the purest water in warm countries. The pond will cease to attract the dew, however, if the straw becomes wet, as it then assumes the same temperature as the surrounding earth and ceases to act as a non-conductor of heat. This always occurs if a spring is allowed to flow into the pond or if the layer of clay is pierced in any way.

Such a method ought to prove valuable to military officers when campaigning where water is lacking.



PHOTOGRAPH OF STEEL SMOKESTACK INTERIOR

This picture was taken from the bottom of a steel smokestack and shows the interior looking upward just after the steel work was completed and before the brick lining was put in place. The stack has an inside diameter of 12 ft. and is 180 ft. high.

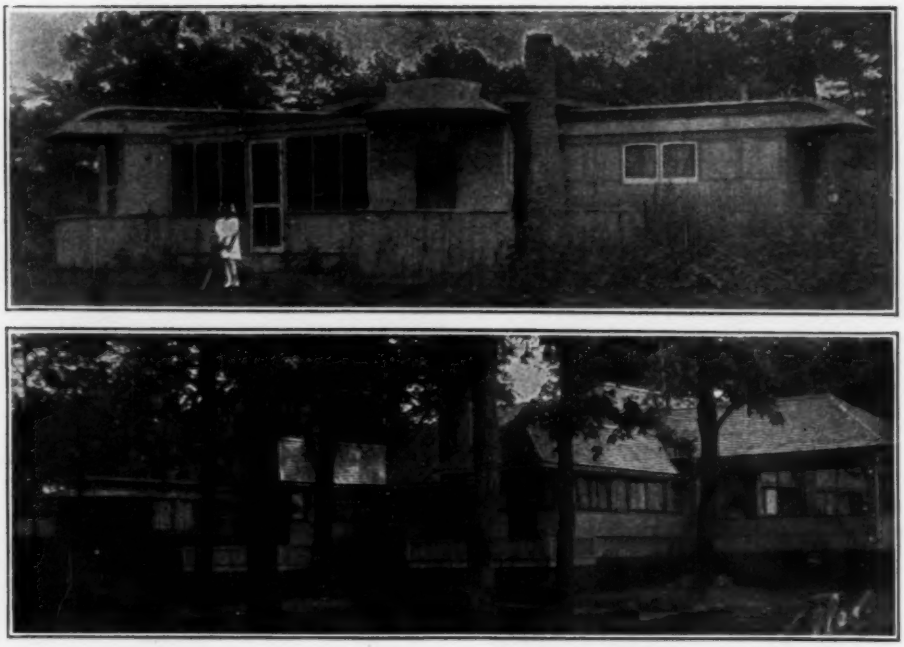
FUN WITH THE FUTURE OF AIRSHIPS

The London artist of the Sketch who is responsible for this grew tired of only drawing on his salary and drew on his imagination to break the monotony. It is his conception of the possibilities of the airship of the future in the hunting field and represents "Hare and Hounds at Hurlingham."

A VILLAGE BUILT OF STREET CARS

One of the most unique and remarkable collections of houses in Minnesota is the street car village at East Shore Park, near Twin City. The houses, two of which are shown in the illustrations, are constructed of the old horse cars from St. Paul and Minneapolis.

The one most clearly showing its



Old Street Cars Grouped to Make Houses

street-car construction is made of six cars, the inner ends of which are joined by a hexagonal room which is used as a living room. The cars are used as bedrooms, dining room and kitchen. The brick chimney is the outward manifestation of the cheerful fireplace which makes the unique house comfortable on cold nights.

A Street Car Bedroom

The other illustration shows a house constructed of eight cars. These have been re-roofed and a number of porches added, thereby losing some of the car effect, but the windows and the underbodies are unmistakable. In the left of this illustration is shown a small house built of three cars.

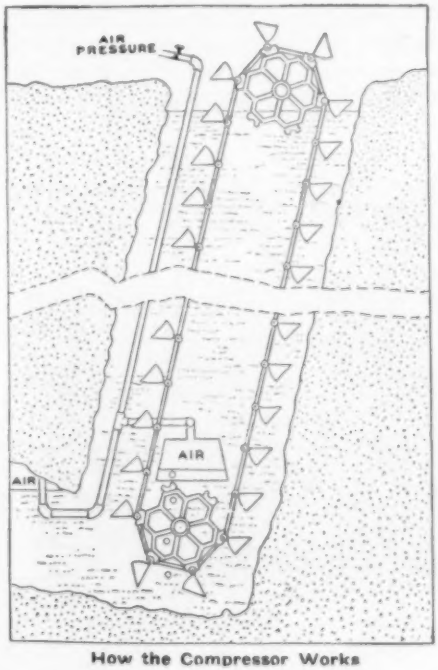
When the city lines were equipped with electricity the company offered the horse cars free to anyone who wanted them. The street car village was the natural result.

BUCKET-PUMP SYSTEM FOR COMPRESSING AIR

This new method of compressing air, known as the bucket-pump system, is creating much interest among mine operators. The principle of the system is found in the working of an ordinary bucket pump. These pumps consist of two cog-wheels over which an endless chain is drawn holding buckets at intervals. If the bucket pump is sunk almost completely under water each

The contingent from the West African regiment of the British army has contributed greatly to this year's military tournament in England. They do not merely show what they can do as natives, but give an admirable display of their skill as English-trained soldiers. Particularly striking is the battle in the bush, the arena at Olympia being transformed into a jungle set with lofty reed grass and palms.

bucket carries a quantity of air, depending upon its size, down with it to the lower cog-wheel, and in turning ejects this air, which in turn rises to the surface. At this lower point the air is under pressure, dependent simply upon the depth below the surface of the water to which it is carried.



How the Compressor Works

The illustration gives a clear idea of the mechanism. The hood, which is placed just above the lower cog-wheel to catch the air bubbles as they rise in the comparatively still water at that point, is simple in design and construction. The only necessity for the installation of this system in a mine is a shaft, either vertical or inclined at any angle, of sufficient depth and capable of being flooded. If the shaft possesses an upward bend or room at its bottom, the latter can be used as a large air receiver and an unknown quantity of air stored until needed for use in case of breakdown or excessive requirements. At the top the water is of course carried to the highest point on the cog-wheel, where it is discharged when the buckets are reversed and fill with air. The water must be raised to this height and represents one of the losses of the mechanism.

The cost of such a system is practi-

cally small. A 200-ft. bucket chain with malleable iron buckets operating in a vertical shaft can be installed complete for a 60 to 70-hp. air capacity at a cost inside of $2,000. Practically all the parts of such a system can be purchased today in the open market without changes other than superficial ones.

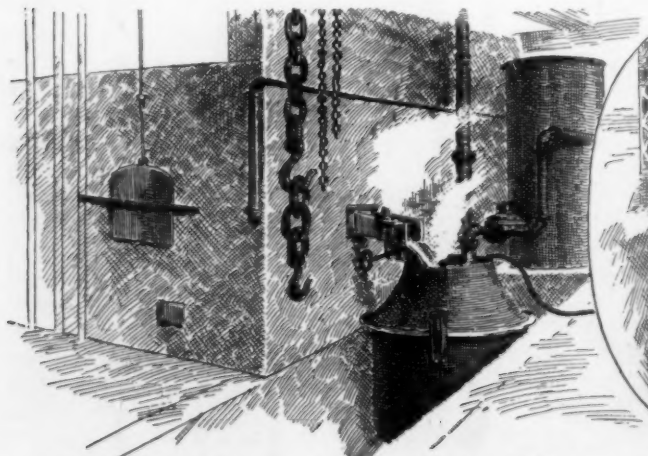
FISHING SCHOONER EQUIPPED WITH WIRELESS

The fishing schooner "Chicago," one of a fleet on the halibut grounds off the west coast of Vancouver Island and southeastern Alaska, has been equipped with a wireless telegraph apparatus. With this equipment she will be able to keep constantly in touch with the wireless stations along the coast and inform her owners as to the weather conditions, the amount of fish caught by the vessels in the fleet, and other matters of importance.

By this method the company can keep its finger on the market pulse even before the fish arrive on the street. It will also enable the dealers in Seattle to regulate the market with greater success, as they will know just the amount of the catch from week to week and can adjust prices to correspond with the supply and demand.

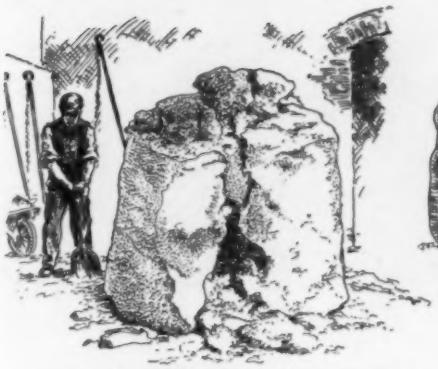
Rock Salt Purified in Five Minutes

An English inventor has devised a process by which it is possible to purify rock salt direct, and on a basis which is not commercially prohibitive. Hitherto, in preparing white table salt from rock salt, it has been necessary to depend upon the evaporation of brine, a method followed by the Romans almost before the present civilization began. His process consists of melting the rock salt, and then driving compressed air through the molten mass. Impurities are separated and deposited, and the salt is left white and pure. The puri-

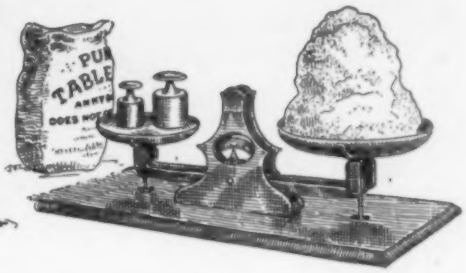


Open-Hearth Furnace where Rock Salt is Melted and Compressed Air arrangement

Method of Conveying Row of Containers



Inverted block of Salt after Purification



Finished Specimen after being Ground

fied salt is found to be exceptionally fine, and, being anhydrous, does not cake after the fashion of brine salt.

The cost of the process is reduced to a minimum and the time required to a fraction of what it was. The illustrations show:

(1) The open-hearth furnace in which the rock salt is melted and the machine that forces compressed air into the containers.

(2) Method of conveying containers.

(3) The salt after purification.

(4) Finished specimen after being ground.

GATHERING SHELLS FOR CHICKEN FEED

In the dredging operations of the government at San Pedro, Cal., about one-fourth of the material taken from the bottom of the harbor is fossil shells. The fill shown in the illustration covers probably 50 acres, and men with screens and shovels gather the shells, consisting of many varieties, and take them to a mill to be ground. The ground shells are mixed with chicken feed to furnish the lime for the chicken-process of egg-shell building.

MOVING A BIG RIVER

The Missouri river at Atchison, Kan., is spanned by a 1,000-ft. steel bridge, consisting of four spans, one of which is a draw span to allow the passage of river steamers. The draw is located at the western end of the bridge, as the natural bend of the river causes the current to flow on that side.

Last spring the river took a notion to cut a new channel on the eastern side, filling the western channel up with sand. This action left the passage

Mining and Grinding Shells a Profitable Industry

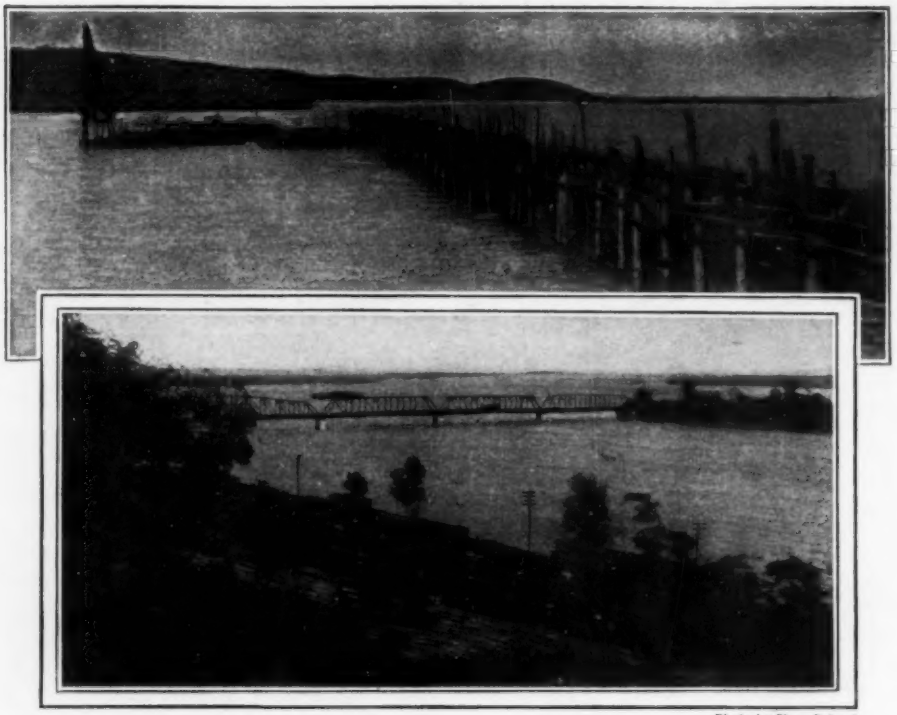


Photo by Clare Poland

The upper view shows the dyke construction which forced the river to return to its original channel, thus saving the bridge shown below.

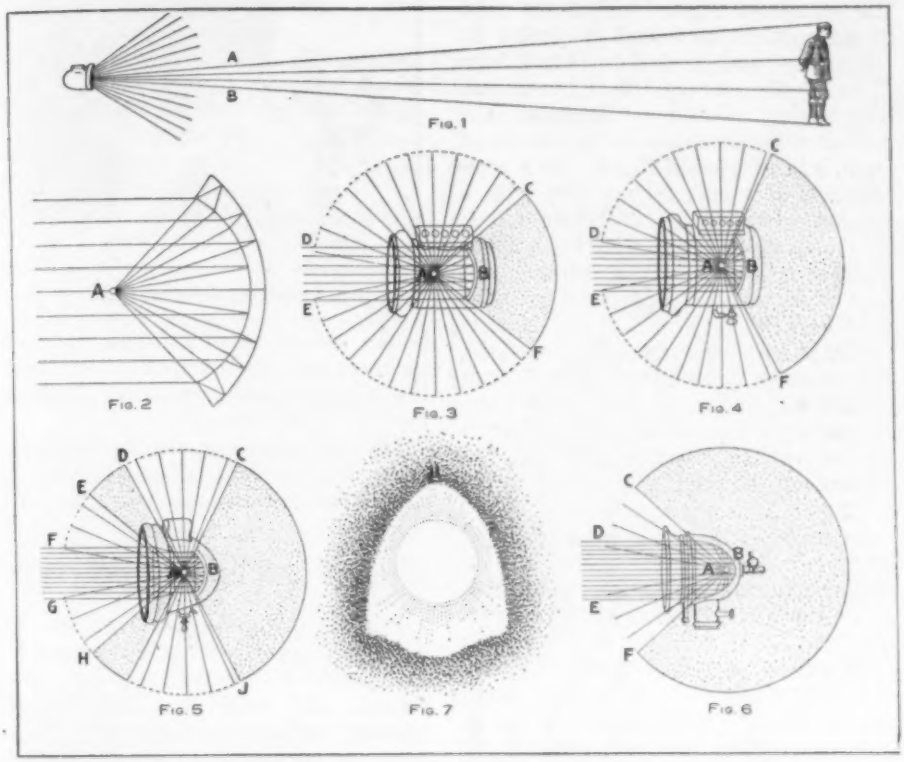
under the draw high and dry and stopped the passage of steamers, causing the government authorities to investigate matters. As a result of the investigation they issued the ultimatum that the bridge company would have to move their bridge or move the river back into the channel it had abandoned.

The latter course was considered the lesser of the two evils and the work of constructing a 900-ft. dyke was immediately commenced. The task was difficult, as the water was 40 ft. deep with a tremendous current. Three rows of 80-ft. cottonwood pilings were driven 10 ft. apart, the pilings also being placed 10 ft. apart in each row. Willows were then woven into a sort of wickerwork, sunk with stone, and fastened between the pilings. Within 30 days after the work was commenced the current was back in its normal position. The first illustration shows the construction of the dyke. The second is the bridge it saved from being moved.

CAR-LOADING MADE EASY

Instead of building these freight yard platforms to a height level with the flooring of the cars, as is the usual procedure, the platforms were laid level with the ground and the space left for the car tracks excavated to a depth which would lower the car floors to the same level as the platforms.

THE CONSTRUCTION OF AUTOMOBILE LAMPS



Popular opinion associates the illuminating power of an automobile lamp with its size and polish, which is incorrect, because it obviously depends upon the intensity of, and distribution of, illumination from the source of light, and upon the number of rays intercepted and reflected by the lens and mirror.

With most lights the illumination is radiated in all directions, though with varying intensity, and, therefore, the problem of the automobile lamp designer is to intercept the rays lost in an undesired direction by the use of mirrors and lenses properly formed to reflect and refract the largest possible proportion of these rays into the direction where brilliant illumination is required. The more effectively this object is achieved the less powerful will be the source of light required to obtain a given illumination.

Fig. 1 shows how little of the light (the rays A and B) can shine on a boy on the road 30 ft. ahead, when no reflector is used and the interior is dull. The diagram shows the rays in one plane only, leaving the reader to imagine those which issue on all sides and in every direction. Only about a quarter per cent of the total light is useful, and such waste would render a head-lamp useless unless it was provided with a light of great power.

In the use of mirror lenses the phenomenon of refraction, as well as that of reflection must be taken into account. Refraction is produced whenever a ray of light passes from one transparent medium into another denser or rarer, and consists of a bending of the ray at the point of contact between the two media. The refraction, produces exact parallelism of the rays issuing from the focus A (Fig. 2).

A long-focus lens mirror lamp is illustrated in Fig. 3, in which A is the source of light, C F is the cone of rays intercepted and projected by the mirror, and from C to D and from E to F the amount of light wasted. The saving effected by bringing the mirror reflector closer to the source of light is illustrated in Fig 4. By a combination of a lens mirror (B) with a portion of paraboloid reflector (D E H I), as shown in Fig. 5, the amount of light falling upon the reflected surface is increased 50 per cent over the total emitted by Fig. A. But if electricity be employed instead of acetylene, the chimney space (D C; Fig. 5) can be closed, permitting the use of an extended paraboloid reflecter without a lens mirror, as shown in Fig. 6. The amount of light thus intercepted reaches 88 per cent of the total.

In order to illustrate by a practical example a few hints on the sort of illumination required on the road ahead, a lamp projection on a wall is shown in Fig. 7. It will be seen that the illumination projected varies at different parts of the beam in the same manner as does the flame itself, of which it is actually an inverted image. The shape of the projection is just suited to actual requirements, the broad portion shining on the road near the car, the brilliant center lighting up objects quite clearly while they are far enough ahead to enable the driver to act, and the narrower portions being thrown far away down the road.

ELECTRIC HAIR DRYER

Probably one of the most satisfactory of all the electric toilet articles is the hair dryer. The machine shown in the illustration is made of aluminum, weighs but 2¾ lb., and drives a strong current of either cold or warm air by the simple turning of a key. Turned one notch, a strong current of cold air is forced out of the tube. Turned two notches and the air becomes warm. The turning of the key

Latest Electric Novelty

to the second notch switches in a resistance, and the current of air flowing through this resistance generates the heat which warms it.

Like all other electric household articles it is connected to a convenient electric lamp socket by an electric cord.

UNIQUE RECRUITING STATION

With an eye to business, the war department recently tied a flag to one of the trees on Fountain square, Cincinnati, and established a naval recruiting station in the park. Hundreds of workless men are accustomed to congregate there each day.

Recruiting in a Park

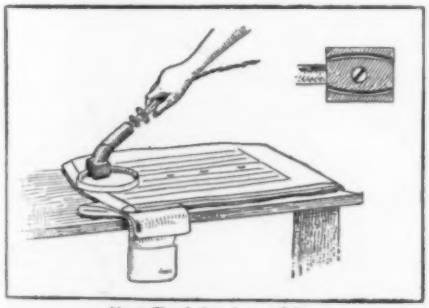
"INDOMITABLE" BREAKS ALL WARSHIP RECORDS

The British battleship "Indomitable," conveying the Prince of Wales back to England from Quebec, broke all records for battleships by maintaining an average speed of 24¾ miles. During one day an average speed of 30 miles an hour was made, and from Belle Isle to Fastnet light the average was 28 miles per hour.

All the officers had a turn at stoking, and the prince threw in six shovelfuls for luck.

ELECTRIC NECKBAND IRONER

This small device, heated with electricity, is claimed to completely do away with rough neckbands, and, when properly used, to make even old bands smooth and comfortable. The device



New Tool for Laundries

has been patented and placed on the market by a laundry firm that hit upon the idea while experimenting.

AMERICA'S RECORD ON PANAMA CANAL

From the time Americans took possession of the effects of the French Company on the Isthmus, May 4, 1904, to the end of the fiscal year, June 30, 1908, there were removed from the canal prism and accessory works 40,938,575 cu. yd. of material. In the fiscal year 1908 the total excavation was 27,979,375 cu. yd., or about 66 per cent of the total amount taken out.

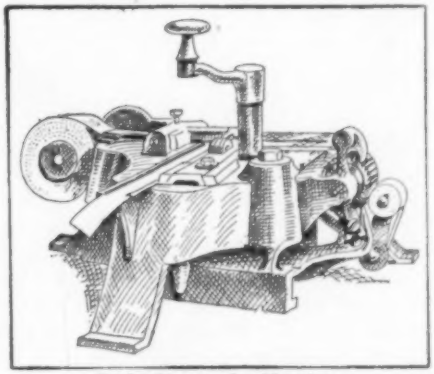
AN INGENIOUS STAMP MACHINE

Among the many stamp machines patented in the last year or two, none is more interesting than the one

Automatic Stamp Seller

shown in these illustrations. When used commercially it sells 4 cents' worth of stamps for 5 cents, either in packets of 4 ones, 2 twos or 1 two and 2 ones. Each sale is delivered in a small envelope-like packet that is cut off from a continuous roll of paper when the crank is turned.

Oiled paper is automatically placed between the stamps to keep them from sticking, and if these anti-stickers are



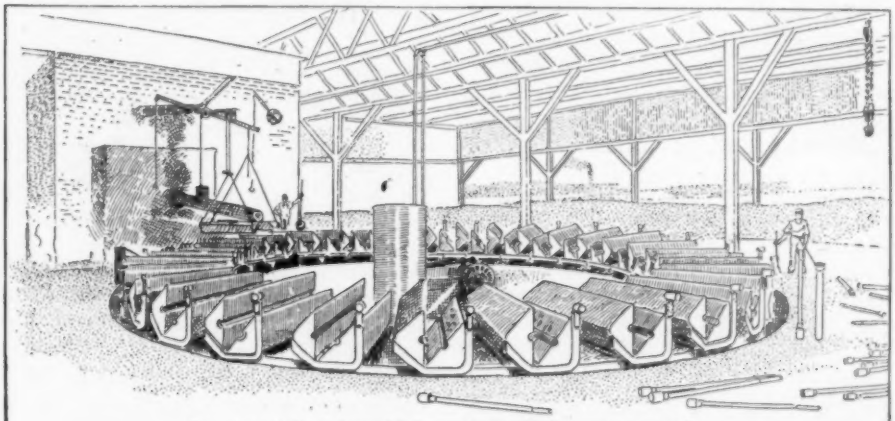
Packs Stamps for Machine

used for advertising purposes the machine receives an additional revenue. Some advertisers use the envelope as a discount stamp, good for 5 cents on a sale of 50 cents and over.

At subpostoffice stations or other places under postoffice control, the machine is loaded to sell 5 cents' worth of stamps. It is claimed to be the only machine made that sells two different denominations of stamps at one sale. The stamps are counted, inclosed and sealed in the envelope by another machine.

CASTING PIPE IN PERMANENT MOLDS

It has long been the dream of every foundryman whose trade requires a large number of duplicate castings to make these castings in molds that would not only survive the process but would also produce castings that would be marketable and could be easily machined. This dream, as far as the casting of water and gas pipe is concerned, has been realized.

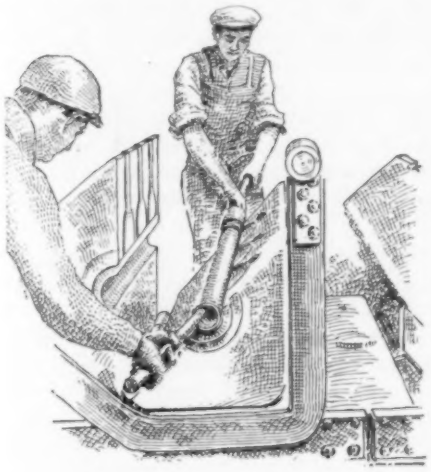


Revolving Cast Iron Molds, showing Cupola and Ladle

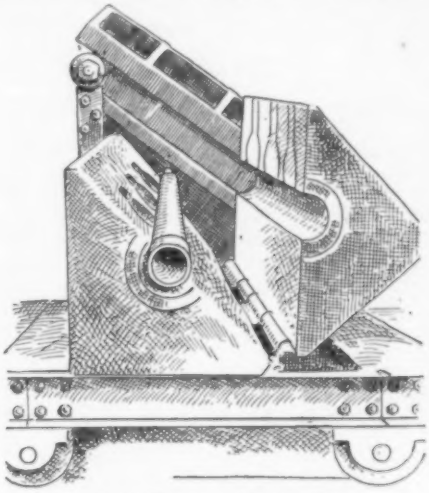
The machine by which it is accomplished consists of a table or ring approximately 40 ft. inside diameter, carrying 30 molds, arranged at equal intervals. The table is constructed of two concentric rings of channel beams, connected with 32 cross-pieces or trucks, each of which has two wheels which run on concentric circular tracks set in concrete foundations. Under the table or ring, at two diametrically opposite points, are arranged two hydraulic cylinders, which slide in ways similar to a planing table, the pistons within the cylinder being held stationary and the cylinder being moved back and forth by the operation of a four-way valve controlling the admission of water alternately to each end of the cylinders. The stroke of the cylinders is of such length as to be slightly more than the spacing of the molds carried on the table. Projecting from the top of the cylinders is an inclined plane surface designed to lift the pins in the trucks when the cylinders move in a direction opposite to the required motion of the table, and to allow a pin at each side to fall after the inclined surface has passed. In this manner each cycle of the cylinders intermittently moves the table ahead a distance equal to the spacing of the molds. The table makes one complete revolution every 7½ minutes, producing 30 pipes in that time, or 240 pipes an hour.

Each mold consists of a rectangular block of cast-iron 18 in. wide by 18 in.

high and 6 ft. long, parted on a diagonal line across the corners, and provided with hinges at the lower edges of the parting, so as to allow the upper

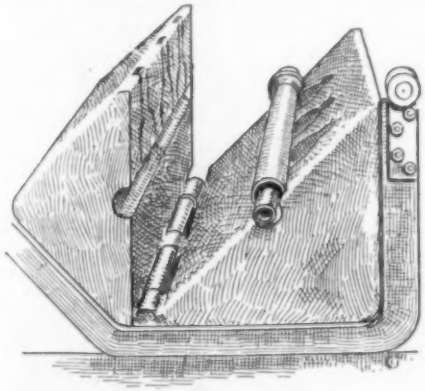


Setting Core



Mold Entering Closing Device

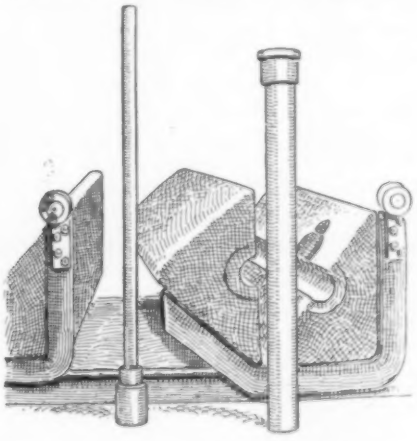
portion or core to be swung up and back from the lower portion or drag. The molds each weigh 6,500 lb. complete. At the center of each mold is the cavity in which the metal is poured to form the pipe.



Open Mold, Showing Finished Pipe

Each end of the mold is provided with rings or bushings, which are used to support the core arbor in an exact central position in the cavity of the mold, so that the pipe when finished shall have uniform thickness of metal at every point. This core arbor consists of a hollow cast-iron cylinder somewhat longer than the pipe to be cast and three-quarters of an inch less in diameter than the inside diameter of the pipe.

The core is made by placing the core arbor in a machine which consists of a



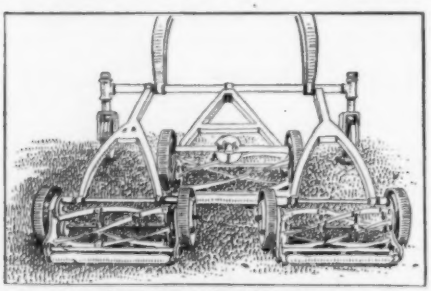
Finished Pipe and Core Arbor, Mold Open

semicircular support for the ends of the arbor, a shaking screen arranged to sift sand, a guide to drop it upon the arbor, and a knife. The arbor is wet

thoroughly and rotated while the sand falls and clings to it. The surplus sand is scraped away by the knife, placed at the proper distance from the arbor to make the finished core of the diameter and shape required, and it is ready for use.

LAWN MOWER FOR UNEVEN GROUND

This one-horse lawn mower, devised by a Connecticut inventor, is being successfully used on golf links where the ground is uneven. The ordinary long-bladed horse mower will not cut in hol-



Arrangement of Mowers

low places, but this mower, consisting of three large hand mowers attached to the framework shown in the illustration, will cut on almost any condition of ground. The swivel joints at the cross bar allow any one of the three separate machines to rise over bumps and sink into hollows without lifting the cutting blades of the other two off the ground. It is also much lighter than the ordinary horse machine.

AERIAL TORPEDOES TO FIGHT AIRSHIPS

Reports from abroad state that the Krupps have bought all rights outside of Sweden for an aerial torpedo, invented by a Swedish artilleryman, and that they will be introduced into the German army and navy.

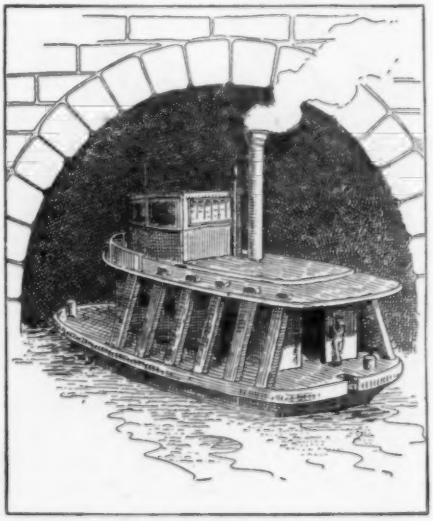
Among other claims, it is stated that the torpedo can be fired without noise or recoil, and that the machine from which it is fired can be placed in position on board ship or on land much more rapidly than field artillery can be brought into action. It is driven by a turbine.

Before the Krupps took up the invention it was tested by the British war office and declined on the ground that it could be of no special advantage in warfare. The next great war, however, may prove differently. The airship is sure to become a great factor in warfare before many years have passed, and it may develop that an aerial torpedo will prove its most dreaded enemy.

IMMENSITY OF ST. LOUIS' SEWER

When the Harlem Creek sewer, now in progress of construction, is completed, St. Louis will have some of the largest, if not the largest, sewers in the world. The main section is 29 ft. in diameter, with smaller sections ranging from 27 to 18 ft. in diameter. The main section and its two branches extend over 4 miles and will drain more than 6,000 acres of land.

There are many longer sewers than this one, and there are drainage systems, not sewers, which drain much larger tracts of land; but there is no sewer in the world that combines such great size with extent of area drained.

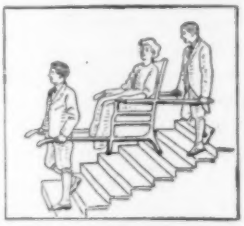


A Navigable Sewer

A Mississippi river tug-boat of the type shown in the illustration could easily steam through it.

INVALID CHAIR FOR STAIR-CLIMBING

The most difficult problem in carrying an invalid about a house or from one house to another is the stairs to be climbed. This chair, manufactured in France, seems to solve the problem. The rear handles or carrying shafts are an extension of the arms, and the forward handles extend out from about a foot beneath the seat. The drop between the front and rear handles is about 2½ ft., and when mounting or descending a flight of stairs the seat is as level as when resting on a flat surface, although one carrier is a number of steps above the other.



AN AMERICAN REVOLVING HOUSE

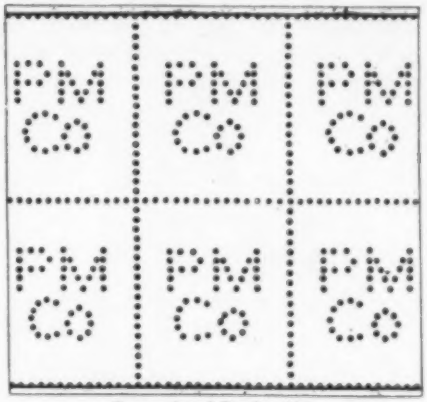
A New York jeweler, who has spent years of thought over genuine home comfort, has had plans drawn for a revolving house, which he will build at Bayside, Long Island.

As proposed, the house will be constructed on a turntable, operated by electric power, and its windows will follow the sun around in the winter time, and avoid it in the summer. Wearying of one view, he may have the house turned around and get another view without leaving his chair. Vagrant breezes may be chased around in the same manner.

The house, exclusive of the real estate, will cost $35,000. The turntable will be operated by electricity. This will not be the only house of the kind in existence. Some time ago we published an illustrated article on just such a house constructed by a Frenchman.

PERFORATE POSTAGE STAMPS TO IDENTIFY OWNERSHIP

The postoffice department has issued an order under which users of large quantities of postage stamps may have them perforated with letters to identify their ownership and prevent pilfering.



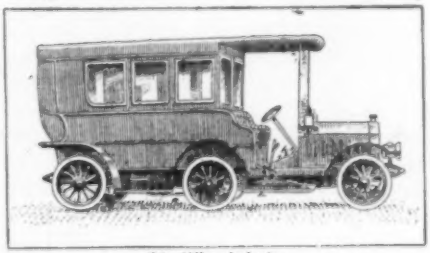
Example of Perforation

The perforation must not be over 1/32 in. in diameter, and the perforated letters must not occupy space more than ½ in. square.

Such a privilege, if taken advantage of, will make it impossible for office employes to steal stamps and sell them to stamp brokers or dispose of them in other ways.

SIX-WHEELED "AUTOMOBILE OF STATE"

One of the most interesting types of foreign automobiles turned out this year

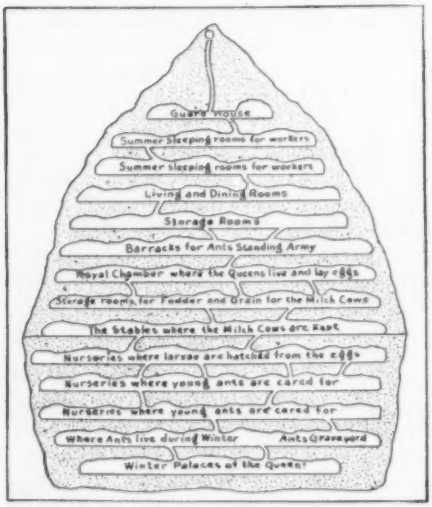


Six-Wheel Auto

is this 40-hp. automobile with six wheels. The driving gear is on the central set of wheels.

THE LIFE, WORK AND METHODS OF ANTS

The world looks on in wonder at such engineering feats as the building of the Panama canal, and the wild talk sometimes heard of a tunnel underneath the Atlantic ocean is laughed at by all of us. Yet armies of ants are doing work every day which, for them, is much more wonderful than what man is doing on the Panama canal, and certain kinds of ants have been known to dig tunnels three miles long; a work proportionately greater than for men to build a tunnel under the Atlantic from New York to London.


Guard House
Summer Sleeping rooms for workers
Summer sleeping rooms for workers
Living and Dining Rooms
Storage Rooms
Barracks for Ants Standing Army
Royal Chamber where the Queens live and lay eggs
Storage rooms for Fodder and Grain for the Milch Cows
The Stables where the Milch Cows are Kept
Nurseries where larvae are hatched from the eggs
Nurseries where young ants are cared for
Nurseries where young ants are cared for
Where Ants live during Winter
Ants Graveyard
Winter Palaces of the Queen

Courtesy The Pathfinder

Section of Ant City

Not only are ants great constructionists but they have their cities and governments just as men do, and, like the human races, civilized or otherwise, they carry on wars. The most densely populated municipalities are those formed by millions and millions of ants. The loop district of Chicago does not compare with the congestion in some of their cities, yet their police force has no trouble in adjusting traffic difficulties. In some parts of the world these little creatures seek out places in the forests and found their cities, made up of dozens of hills which reach up 4 or 5 ft. and are from 20 to 30 ft. in circumference.

On the outside these hills or ant palaces look rough and crude, but order and decency reign within. The hills have as many as 12 and 15 floors, connected by staircases, and here, divided according to their station, the various grades of ants live, work, die and are buried. Every ant hill has its cemetery.

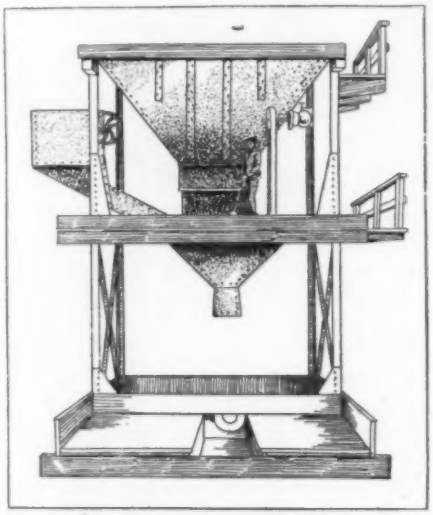
The ant municipality has in it three grades of people; the kings and queens, the aristocrats and the workers. Some of the ants act as soldiers, some as police, others as household servants or as working civilians. And every one does his or her duty, or pays the penalty, even the aristocrats. If one of the workers tires of his or her task a fat ant policeman, or he may be thin, comes along and off goes the head of the sluggard. Up at the single entrance into the ant hill will be found a sentry, day and night, keeping watch lest some sudden attack be made on the citadel. When a hostile body of ants is seen marching in his direction the alarm is given and the soldiers are immediately mobilized to go forth and give battle to the invaders. Woe betide even as powerful an enemy as man if he approach too near some kinds of ants.

The door of the ant hill opens into a passage about a quarter of an inch in diameter, and this leads downward into the house proper. Galleries branch off in every direction, connecting with all sorts of rooms, which vary in size, according to the purpose for which they are built. The construction can be better explained by the illustration than by word pictures.

The compartments for the milch cows, however, may be a little confusing to the uninitiated if not explained. Ants have their aphids, or milch cows, and dairymen look after them very carefully. When springtime comes the attendants drive the aphids out to pasture on the blades of new grass, each day taking them to a new place. Then at milking time the milkmaids take the ant-cows and stroke them with their

feet until they yield a drop of milk.

There is always a nursery full of children, as the queens lay thousands of eggs, which are hatched by other ants. The infants and their nurses are interesting specimens of the race. When the little fellows are about four weeks old they spin around themselves a soft kind of blanket, in which they lie dormant for several days, and the nurses take a rest. When they awake they must be helped out of their blankets, given a bath and prepared for a trip outdoors. The young ants have wings and the queens lead them into the open air for a short fly. After the flight their wings are torn off and they settle down to become industrious.

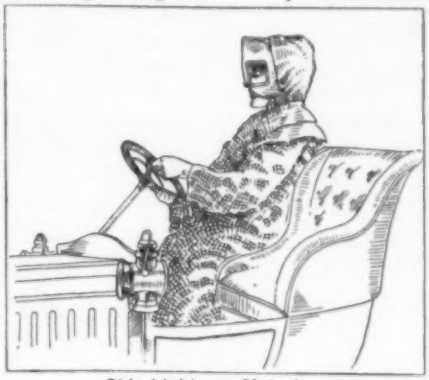


A GIANT CONCRETE MIXER

One of the largest concrete mixers in the country is being used in the work of constructing the Monongahela river dam at Brownsville, Pa. It has a capacity of 45 cu. yd. of concrete an hour and can be operated by one man. It runs along on a tramway as the work progresses. The sand, gravel and cement are raised by an elevator, which places it in the proper bins at the top of the mixer. The sand and gravel hoppers are 16 by 16 ft. and the cement bin, 5 by 7 ft.

SIDE WINDOWS IN MOTOR HEADGEAR

In this illustration is shown the new motoring headgear worn by the women



Side Lights on Motoring

automobile enthusiasts of England. A window in each side of the bonnet is the suggestion of an Englishman who "also" feels that he has a right upon the highways, and fears for even the little chance of safety that has been left him unless his suggestion is accepted.

WIRELESS-TELEGRAPH BADGE FOR BRITISH NAVY

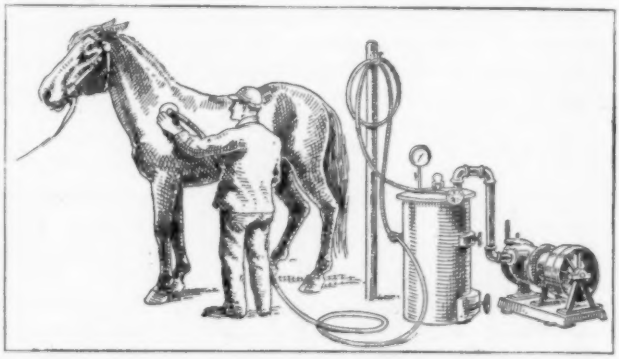
This gold badge has been designed for the wireless telegraphy branch of the British navy and every man who becomes proficient will be awarded one. It is worn on the right sleeve just above

Badge for Wireless Corps

the elbow. A fully qualified wireless telegrapher wears one star above the badge; a first-class petty officer, two stars, and a chief petty officer, a small crown.

VACUUM APPARATUS FOR CLEANING HORSES

The vacuum machine as used for cleaning the furnishings of homes and office buildings has become a familiar sight in nearly all parts of the country, but such a machine used for cleaning horses is new to most people. The apparatus consists of a vacuum pump, an electric motor or gasoline engine, a steel vacuum tank, a vacuum gauge containing a separating diaphragm, a number of vacuum combs and various connecting pipes and tubing.



A horse can be thoroughly cleaned by the machine in from three to five minutes, while with the ordinary curry comb and brush the task takes from twenty minutes to an hour of vigorous rubbing. It removes all dirt on the animal's skin, cleaning both the surface and the pores.

BALLAST FROM MISSISSIPPI RIVER

One of the most serious problems of railroading in the Mississippi Valley has been solved by the discovery that the Mississippi river pebbles will make a durable and satisfactory ballast. The geographical formation of the valley contains practically no limestone, a poor supply of stone and sand, and none of what is termed "free gravel." But with the river pebbles, which have been washed clean of clay by the water of ages, is mixed about 35 per cent of ordinary sand, the mixture producing the finest dustless ballast yet discovered.

Railroads in the south have always suffered through the lack of good ballast, with the result that a track brought up to standard becomes "wobbly," if not positively unsafe, after a short period of heavy traffic. This settling has usually been caused by the large per cent of clay mixed with the ballast, which dissolves and disintegrates with the rain.

The Illinois Central Railroad is taking from the river bed at Memphis 1,500 cu. yd. of gravel a day, and the other roads are expected to follow suit. The gravel is found in bars and consists of pebbles ranging from the size of a pea to 2 in. in diameter. The availability of this gravel for ballast is exceedingly pleasing to the government also, as the using of it will remove many of the bars which have interfered with navigation. The gravel is dredged from the bottom of the river from a depth of 15 to 50 ft. by hydraulic action.

CONSUMPTION OF GASOLINE IN ENGLAND

The consumption of gasoline in England has grown from 30,000 tons in 1904 to 100,000 tons in 1907, and this year it is expected to reach 120,000 tons. The greatest bulk of this comes from the East Indies. During the first six months of this year Borneo, Sumatra and British India came forward with 11,000,000 gal., while the United States sent England only 1,-

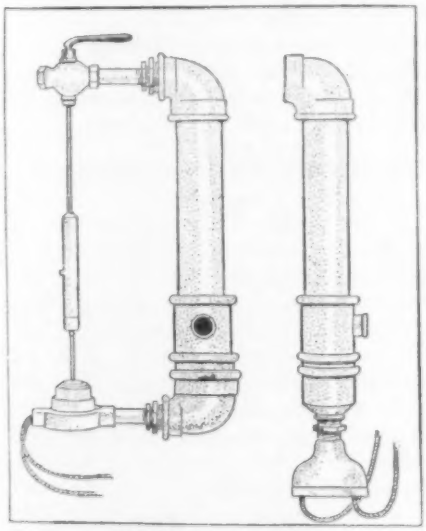
80,000 gal. The ever-increasing demand in America must be filled before foreign shipments are considered.

SUFFRAGETTES ON THE THAMES

One of the most original devices of the recent suffragette demonstrations in London was the use of a megaphone by one of them on the Thames. Seated in the back of a rowboat, she addressed the crowds on the terrace and on Westminster bridge.

AN ELECTRIC WATER HEATER

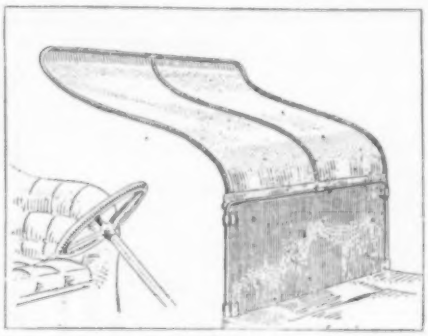
Among the various electrical cooking devices and household cleaning apparatus there seems to be one thing that has been overlooked. The heating of water for the lavatory or bath has either been accomplished with the aid of a gas heater or the kitchen range. A simple device as shown in the accompanying illustration shows a bath and lavatory instantaneous electric water heater constructed by using ordinary pipe and fittings in which are two electrodes. The cold water enters the heater at the bottom, is heated by the electrodes while flowing through, and comes out of the faucet connected with the top of the heater, at any temperature desired, the degree of heat being regulated by the flow of water. A cup of steaming hot water can be quickly drawn. The water heater has an electric switch attachment that turns on both the electric current and the flow of water at the same time. The one constructed for the bath is connected to a switch conveniently located and the flow of water regulated by the ordinary faucet.



Heats Water Quickly

CURVED CELLULOID SCREEN FOR AUTOMOBILES

This automobile screen is composed wholly of celluloid panels heavy enough to stop a large-sized stone and deflect it. It does not altogether serve as an armored shield against missiles, however, as the practice is for the driver to look over the screen instead of through it, but it does protect all but the top of his head. The reason for curving the screen backward from the dashboard is to protect the driver from the back draught which catches him in the neck when the screen goes straight up from the dash.



An English Idea

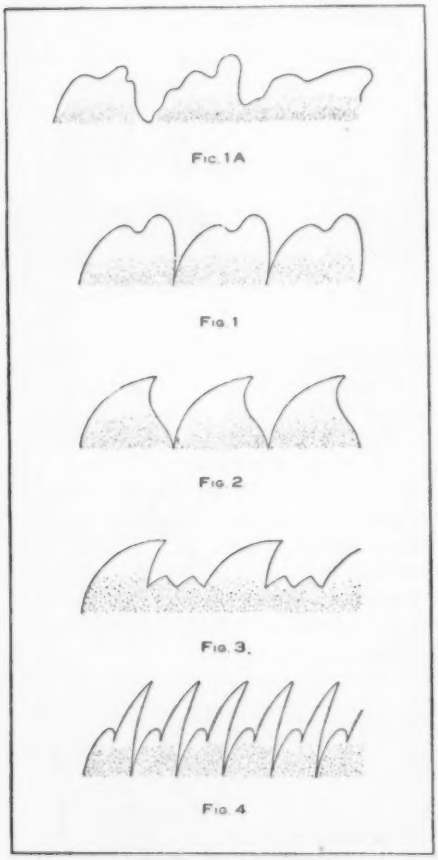
SKYSCRAPERS OF ANCIENT TIMES

The skyscraper is not as modern an invention as the majority of people believe, and even ancient Rome had its troubles with building regulations. In the times of Augustus the tenement houses in Rome became so high to be

dangerous and laws were passed condemning a number of them because they were more than 100 ft. high. This was before Rome was burned in Nero's time, when the streets were no wider than the alleys in the American cities of today. High tenement buildings were numerous in many ancient cities because of the lack of ground space within the walls.

VIBRATIONS OF THE VOICE IN LIGHT-WAVES

These are light-waves, not the teeth of some horrible pre-historic animal, and represent vibrations of the human voice. They are produced by making

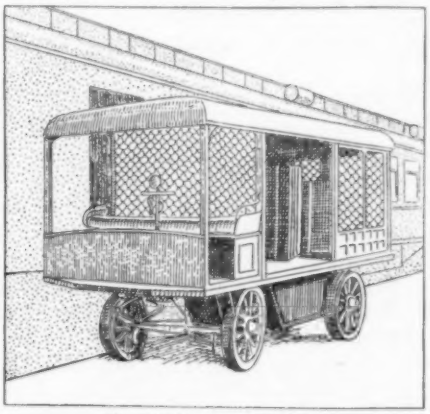


Diagrams of the Voice

the sound fall or dash against a luminant. No. 1 shows the bass G equally and unequally produced; No. 2 shows A perfectly produced; No. 3 is treble D, and No. 4 is D, an octave higher. The instrument by which these records are taken is used in teaching speech-culture and voice-production.

ELECTRIC BAGGAGE TRUCKS

An innovation has been started in the handling of baggage by the introduction in Jersey City of large electric automobile trucks to carry trunks from



Electric Baggage Wagon

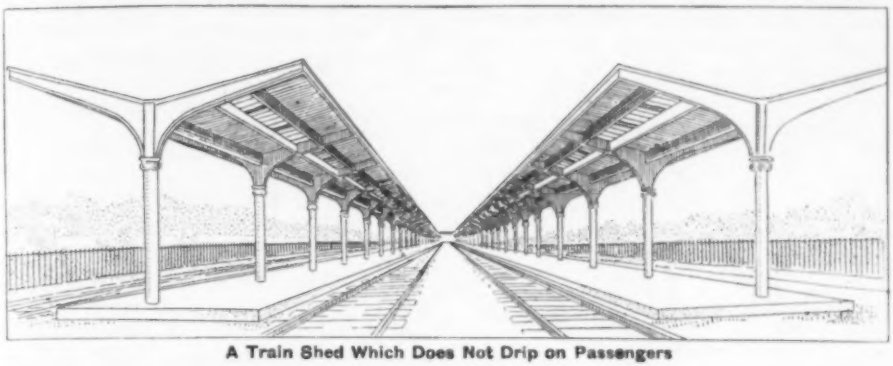
the baggage cars of the Pennsylvania railroad in Jersey City to the Twenty-third street station in New York. The trucks are 15 ft. long, 5 ft. wide, and 9 ft. in height. In making the trip across the river they are raised and lowered to and from the ferry level on elevators. Many hard knocks are saved every trunk handled in this way.

POSTOFFICES ON WARSHIPS

As the result of the joint action of the secretary of the Navy and the postmaster-general, growing out of a recent provision of Congress, every warship in the United States navy will have a postoffice, equipped with all facilities to transact every kind of postal business, and presided over by a full-fledged postmaster. The warship postmaster will have authority to issue and pay money orders, to register and deliver registered mail matter, and to sell stamps and make mail dispatches.

INVERTED UMBRELLA-SHAPED TRAIN SHEDS

The train sheds of the new Union station at New Orleans have inverted umbrella-shaped roofs. Consequently, on rainy days the water runs down the center instead of off the sides on the heads of the people boarding the trains.



A Train Shed Which Does Not Drip on Passengers

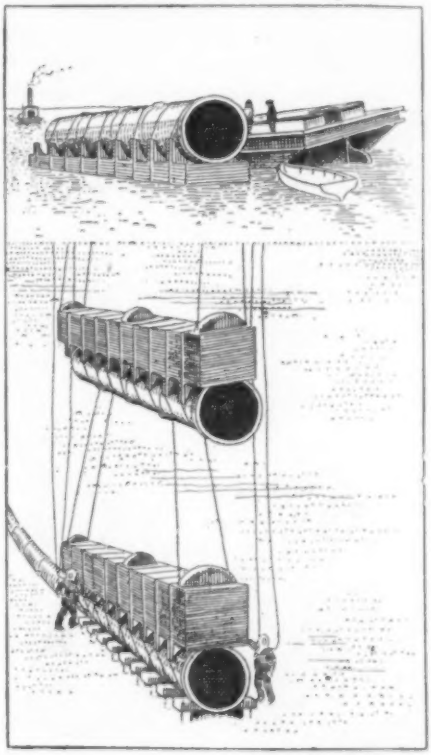
ICE HOUSE EXPLODES

One of the most remarkable explosions ever occurring in Iowa was caused recently by the irresistible force of the expansion of a great mass of sawdust and ice in a large ice house at Mason City. A protracted spell of unseasonable rainy and damp weather was the seat of the trouble. The walls gave way with a dull, heavy boom, and planks and sawdust were thrown 100 ft. into the air. Persons in the vicinity believed at first that the building had been dynamited.

LOWERING PIPE INTO POSITION UNDER WATER

Various methods have been adopted for handling and lowering lengths of pipe into position under water, but this patent caisson affords many advantages. The illustration shows a section of 60-in. cast-iron pipe being lowered.

The caisson is 6 ft. square by 52 ft. long, divided into nine compartments, which can be separately flooded. When empty the caisson supports 24 tons, but when filled with water it will sink with such a load. The section of pipe is made fast to the cradled top of the caisson, which turns over when released from the barge and fills with water. When the bottom is reached the divers adjust the section to line and grade, calk the joints, and then cut the caisson loose. It is then hauled up and pumped out in readiness for another trip.

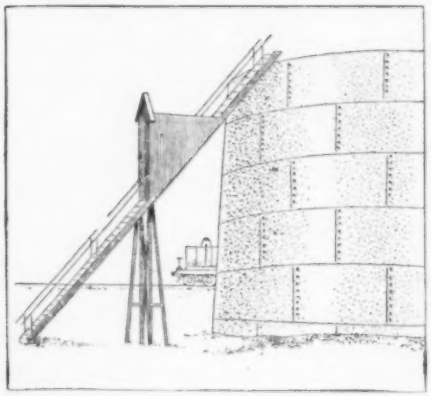


Courtesy Jour. of Electricity

Lowering 60-In Pipe

A BARRIER FOR OUTER STAIRWAYS

Outer stairways, especially if they lead to positions from which a good view of the surroundings can be seen,

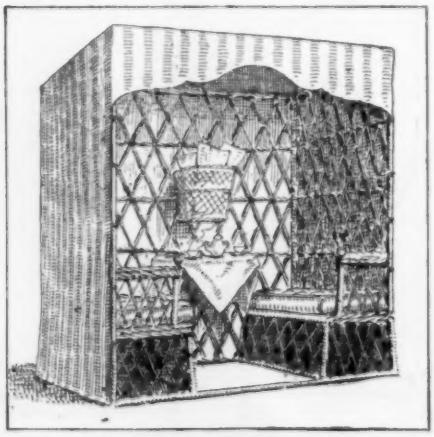


A Stairway Gate

are an irrepressible temptation to boys, and sometimes to their elders. This outer stairway was made impassable by the building of two V-shaped walls and a door half-way up.

PORTABLE WICKER ARBOR

One of the most comfortable and artistic arrangements of lawn seats and canopies to be found on English country and suburban estates is the portable wicker arbor shown in this illustration. The wicker framework of the top, sides, and seats, is one complete piece. Striped canvas covers the top and sides, the bottom is matting, and the two seats are covered with cushions. The table is hinged to the wickerwork of the back wall and lets down. Being light, it is easily turned in any direction.



Comfortable and Portable

REPTILE HATCHES EGGS BY AID OF ELECTRICITY

A 28-ft. python, coiled on 40 eggs in a Chicago amusement park exhibit, suffered from weather conditions which changed from blistering heat one day to almost winter weather the next. It was impossible to move the huge reptile

Courtesy Electric City

Electricity Hatching Snakes

and its eggs, so on the cold days it was kept warm with an electric luminous radiator and electric heating pads.

TO DEVELOP THE RAT-CATCHING INSTINCT IN CATS

In connection with the work of exterminating rats from Honolulu, Dr. L. E. Cofer, of the U. S. Marine hospital and president of the Board of Health, is preparing to develop a breed of cats which will display the rat-catching instinct to the highest degree. This will be done by natural selection and cross-breeding. All residents of Honolulu who have cats that are especially good ratters have been requested to contribute them.

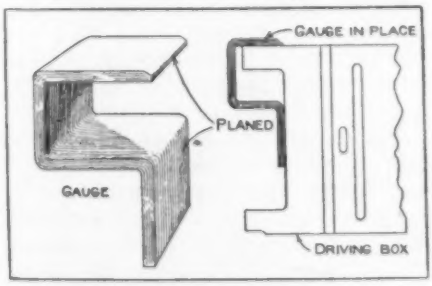
SHOP NOTES

A Handy Shop Ladder

A ladder constructed as shown in the accompanying sketch makes a very useful device around a machine shop for oiling or adjusting line shaft bearings while the machinery is in operation. Two hooks of metal are bolted to the ends of the ladder as shown, so that they will hang over the shafting for the upper support while the lower end rests on the floor. Overhead work may be accomplished with this ladder while the shafting is running.—Contributed by Frank J. Roby, Mandan, N. Dak.

How to Make a Driving Box Gauge

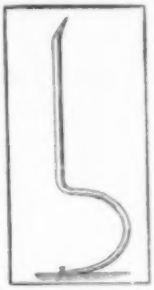
The accompanying sketch shows a gauge for transferring the line where the driving box shoe bears on the outside of the box for the purpose of centering the brass which is necessary when boring worn or new bearings. It is important that the gauge should be planed or otherwise made perfectly level on the bearing side, as this is nothing more than an offset straightedge.—Urban A. Towle, Rumford, Me.



Details of Driving Box Gauge

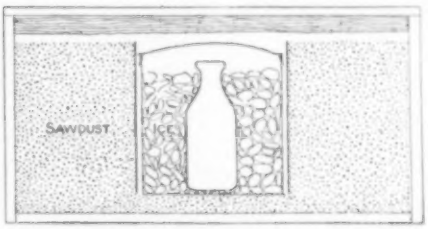
Improved Spike Pulling Bar

The accompanying sketch shows an improvement in a bar for pulling spikes. Instead of being made like a crowbar, or an inverted bar, which makes it necessary to stoop, to push down with the former or pull up with the latter, it is made vertical with a half-turn hook, in the end of which is cut the V-slot for the head of a spike.—Contributed by J. E. Histed, Shawnee, Okla.



Home-Made Milk Bottle Ice Box

At a cost of from 25 to 50 cents anyone can make one of these milk bottle ice boxes. Any ordinary wooden box about 13 by 18 in., with a depth of 12 in., can be obtained from your grocer. In the bottom of this box place plenty of sawdust and on this set a tin pail or can that is 8 in. in diameter and high enough to take in a quart bottle of milk. The pail must rest on sawdust and not on the bottom of the box.

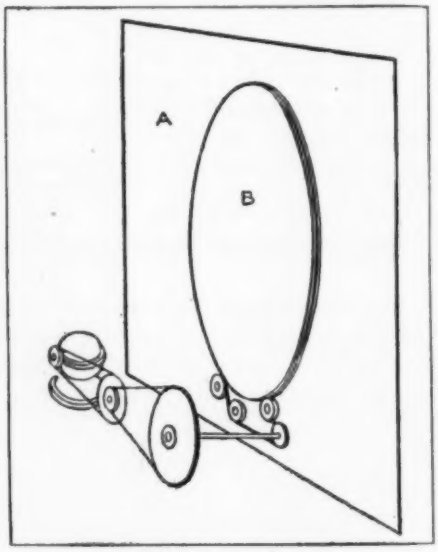


Keeps Milk Cold and Sweet

Place a cylinder of tin around the pail, which is a little larger than the pail, and pack sawdust about the cylinder, filling the space full up to the level of the top of the pail. Fasten with nails or tacks about 50 layers of newspapers to the under side of the box cover. The milk bottle is set in the pail and broken ice packed about it. An ice box of this description will hold two quart bottles of milk. It will take about 2 cents a day to operate this cooling device.

A Mechanical Moving Window Display

The display board, A, is 6 ft. 6 in. square, out of which is cut a 5-ft. wheel, B, as shown in the sketch. This



Run by Electric Motor

wheel is mounted on a ball-bearing grindstone shaft, with the ends resting on tripods both front and rear, the long end of the shaft on the front side of the wheel, which permits the display of any kind and size of goods. The legs of the front tripod supporting the shaft should be concealed by two large articles, such as guns, etc., says the Sporting Goods Dealer. The tripods and axle are not shown in the sketch. The wheel is made to revolve by an electric sewing machine motor cleverly harnessed to it. The method of operation will doubtless be clear from the sketch, but it may be explained that the motor is belted to a 4-in. awning pulley on the shaft with a 1½-in. awning pulley, the latter being belted to a sewing machine drive wheel on a shaft of ½-in. round rod, with a 2-in side pulley at the other end. The main drive belt is a No. 7 sash cord, which runs in a groove cut in the circumference of the wheel B. The arrangement of the pulleys reduces the speed of the large wheel to about four revolutions a minute.

Use and Abuse of a Watch

The winding of a watch should be regular, even and without jerks and not fast, so that the oil flows smooth and not in spasms around the coils of the mainspring. It should not be wound too tight, as this will make the oil leave the inside of the coils, thus allowing the spring to unwind by jerks, causing it to break in time. The winding should be done in the morning, as it will stand the jolts and jars better when the balance takes its full motion.

A spring never breaks from the thickening of the oil, unless inferior oil, or too much, is used. Just enough oil should be placed in the oil cup for each job, or at least every day, so that the lubricating qualities may be retained. Good oil may be ruined by exposing to the sun or leaving it uncovered.

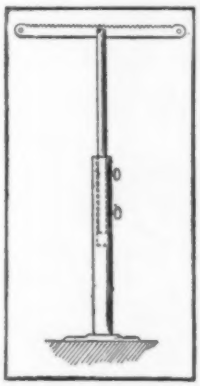
Mainsprings are often put in watches and not examined as to trueness. The coils may be uneven, when they will rub both sides of the barrel, wearing off the metal and hindering the recoil, as well as rendering the oil useless.

The pocket where a watch is to be carried should be made to fit it, and nothing put in this pocket but the watch. Chamois skin is the best material, as it is elastic and a non-conductor of heat, cold or electricity. When not in use a watch should be either laid

flat, face up or down, giving the oil a chance to enter the bearings. When the oil becomes gummy, cleaning will be necessary. This will depend upon its use, but in no case should a watch run over two years without cleaning.—Contributed by Hugo F. Franson, Chicago.

Removing Static Electricity from Belts

In a machine shop where the machinery is run by a large induction motor much trouble was experienced with the static discharge from the main belt, says Power. A simple yet effective means used to remedy the trouble is shown in the sketch.

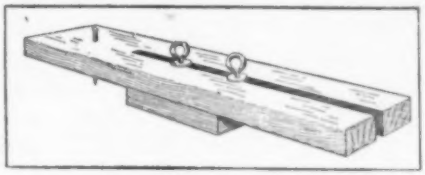


A piece of 1-in. stock was cut to a length of 10 in. and drilled with a $\frac{9}{16}$-in. drill for 5 in.; then tapped for two $\frac{1}{4}$-in. thumb-screws. A piece of $\frac{1}{2}$-in. stock was cut to a length of 12 in. and a 10-in. hack saw blade was riveted on one end as shown. A base plate was then fastened to the 1-in. piece and this was set in place and grounded to the lightning arresters. The $\frac{1}{2}$-in. piece was dropped into place and set at the required height by the thumb-screws. Pipe 1 in. and $\frac{1}{2}$ in. could be used in the place of the solid stock.

Home-Made Joiner's Gauge

At one time being placed in a position where I had everything needed but a wood gauge, I made a makeshift, as shown in the sketch, says a correspondent of Woodworker's Review. This gauge gave as good results as one costing many times more.

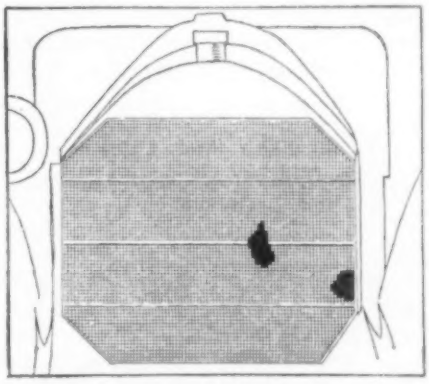
The gauge is 8 in. long, $1\frac{1}{4}$ in. wide and $\frac{3}{8}$ in. thick. The main piece is slotted part way to admit two No. 8 screw eyes that hold the sliding block. The sliding block is $2\frac{1}{2}$ in. long. Washers $\frac{1}{4}$ in. in diameter are used on the screw eyes to prevent the rapid wearing away of the wood. A small brad is placed in the end for the marking point.



Handy Home-Made Gauge

Repairing Automobile Radiators with Cement

A honeycomb radiator of the usual type, built up from an enormous number of small tubes, expanded at the ends or separated by wires and soldered together, is difficult to repair with facilities less complete than those employed for the original assembling. Any attempt to solder has an unpleasant tendency to extend the area of leakage, the heat of the iron melting the solder in the neighborhood of the break as well as that it is sought to apply. On this account it is practically impossible to effect a satisfactory emergency repair of such a radiator with solder, and recourse must be had to some other method, says the Motor Age. Such a method is found in the

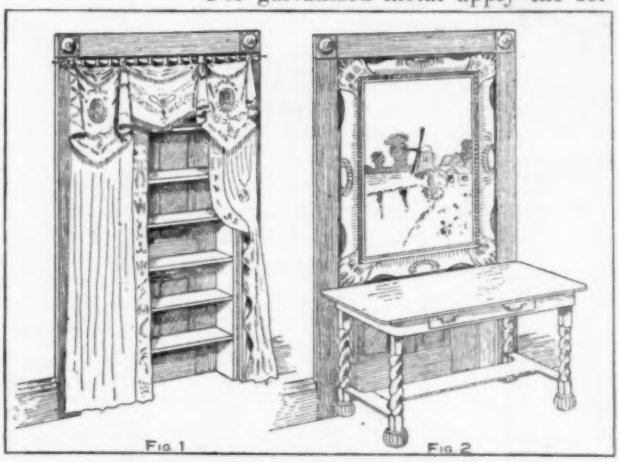


Repairing Leak with Hydraulic Cement

use of a good quality of hydraulic cement, with which the interstices of the radiator surrounding the leak are completely filled. This will most effectively stop the loss of water, and, if the leak is only a small one, will not cut down the radiating surface to any great extent.

Utilizing an Unused Door

A doorway unused for some reason or other, and the door kept locked, can be utilized by converting its recess into a bookcase. This can be done by setting up two vertical boards on each side of the door jam, and on these boards nail the cross-pieces on which the shelves are to rest, or, better still, fasten them with screws. The entire woodwork should match that of the door and casing. If this cannot be done, then the wood should be stained to match it as near as possible. A curtain may be hung from a rod fastened just inside of the door jams, or, if the recess be shallow, from a rod fastened across the outside of the door recess, as shown in Fig. 1.



Two Ways of Using a Closed Door Space

A closed door also makes a fine recess in which to place a painting. If the painting is not long enough to fill the space, a stand can be placed in front, as shown in Fig. 2. Draperies may be applied in this case should the particular painting not be of sufficient width to fill the space.

Decorating a Metal Ceiling

Metal ceilings are usually prepared by the manufacturers, who give them a coat of dipping paint that dries hard enough to enable them to stack the sheets on top of one another and box them for transportation. This is done to keep them from rusting, says the Painters' Magazine, and unless they are abrased in fastening them on the ceilings they need no other treatment before painting, but a good washing with naphtha to remove grease and dirt. When sheet steel or galvanized metal has been put up without any previous preparation or shop coating, it is necessary to use a special priming in order to avoid the risk of peeling of the paint from the metal.

For galvanized metal apply the following solution before painting: One ounce each of copper nitrate, copper chloride and sal ammoniac are dissolved in ½ gal. of water, and when this is effected add 1 oz. of commercial or crude hydrochloric acid. The solution must be made in an earthen or glass jar, or bottle, not in tin cans or other metal. Any druggist can furnish the ingredients or make the solution for it. Apply to the metal with a soft brush and let stand for at least 12 hr., when a grayish film will have formed. Go over this with the duster; then go ahead with any good oil paint that you wish to use, and you need not apprehend any risk of peeling. If the metal be sheet steel, the best preparation is to remove grease or dirt with naphtha. The first coat of paint should be semi-flat, in order to have it adhere well. A priming made from keg lead with any desired coloring matter, ground in oil, thinned with equal parts of coach japan, rubbing varnish and turpentine,

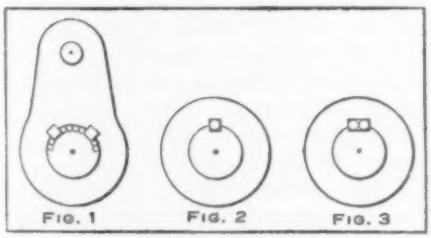
will give the desired result. Any other paint, glossy or flat, will adhere well to this coating.

Moving a Cement Sidewalk

A contractor was called upon to move a cement walk that is 5 ft. wide and 62 ft. long. The first thing he did was to remove the dirt on one side to a point where the walk was to be placed and a sand bed put in. Stakes were driven in the earth with their tops level with the lower edge of the walk. Some pieces of wood were laid on top of the stakes with their ends extending under the edge of the walk. Planks were placed on the other edge of the walk, against which a number of jackscrews were set. Each screw was set up a little at a time and the walk was easily moved all in one piece.

How to Remove Hubs and Keys

After spending several days in trying to force a disc off from a large shaft by pressing and driving, the scheme shown in Fig. 1 was tried with success, says a correspondent of Southern Machinery. A row of 1¼-in. holes were drilled in the end of the shaft, the holes being close together and also as close to the disc as possible without injuring it. The length of the row was made equal to half of the circumference of the shaft. After drilling the holes the crank disc was easily pressed off.

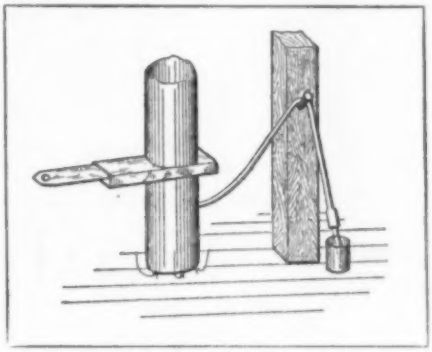


Removing Hubs and Keys

When repairing machinery it often becomes necessary to remove a key having its head broken off and, in some cases, the end badly battered. If it is a square key, it can be loosened as shown in Fig. 2. Drill a hole lengthwise of the key of the largest diameter possible without injuring either the shaft or the hub. Then drive a cold chisel between the key and the hub, the chisel being flat on the side next to the hub and having the slope or bevel and a high center next to the key. The effect of the chisel will be to collapse the key, after which the shaft can be driven or pressed from the hub. If the key is flat like that shown in Fig. 3, drill two or more holes.

How to Test Exhaust-Fan Suction

It is well to make some tests at several of the suction pipes and ascertain just what speed of fan is required to take the shavings away in good shape, says Wood Craft. Having found by this experiment what speed of fan will take the shavings away properly, ascertain the amount of air pressure or exhaust pressure necessary for the work. This can easily be done by means of a little instrument called a draft gauge, which should be made and used as here illustrated. It has a piece of rubber tube, a piece of glass tube which will fit inside the rubber tubing, and a tumbler of water.



Using the Draft Gauge

Punch a hole in the exhaust pipe and insert the rubber tube as shown by the sketch. Place the glass tube in the tumbler of water and note how far above the surface of the water in the

tumbler is the surface of the water in the glass tube. It will probably be between 1 and 2 in. Test the other exhaust pipes. If all of them show about the same amount of water suction, then the pulleys may be arranged in the fan drive so that the given pressure of water will be maintained at all times in the exhaust pipes.

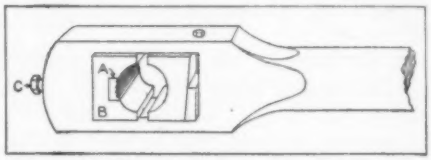
Broken Bottles Used for Insulators

The farmers in a hop-growing section of Oregon constructed a farmers' telephone line by using such material as they happened to have at hand. The line was built of wire which had been used as a trellis for the vines. This wire was tied to the necks of bottles which took the place of the ordinary glass or porcelain insulator. A large spike driven through leather washers and into the pole or cross arm fastened the neck of the bottle to the support as shown.

Truing Up a Wrist Pin

When getting some repairs done on a crank special attention was given to lining it up on the boring table or face plate preceding the boring, to be sure that the hole was bored parallel to the wrist pin. From some cause or other the hole was not bored true and the crank would run hot, although apparently it was loose on the pin. It was found that the crank-pin was not parallel to the shaft, and the problem was to make it so without taking it to the shop again. It was decided to make a cutting tool out of the front half of the brass box, as shown at A in the sketch. This tool consisted of flutes on a rectangular piece of tool steel, the tool being recessed into the front half of the brass crank-pin box, B.

A ⅜-in. tapped hole was put in the end of the connecting rod, and a cap screw, C, inserted to adjust the cutting tool against the crank-pin, the plan



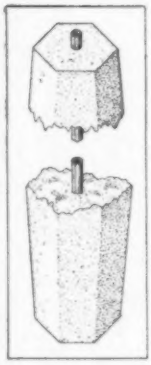
Cutting Tool in Crank-Pin Box

being to turn the flywheel of the engine by hand and allow the cutting tool to trim off the crank-pin on the high places.

After this was accomplished the cutting tool, A, was taken out and the box babbitted. No heating occurred when the engine was started, and the crank-pin gave no farther trouble.

Placing Concrete Piles

In a good many instances piling are placed in low places where there is soft soil or all sand. A patent was granted to a California man for making a concrete pile that can be placed in soft earth with its own weight. When making the pile a gas pipe of suitable size is placed in the center of the concrete as shown in the accompanying sketch. When the pile is placed, water pressure is applied to the top of the pipe. The water pressure as it flows out at the lower end of the pile washes away the loose soil and the pile sinks with its own weight.

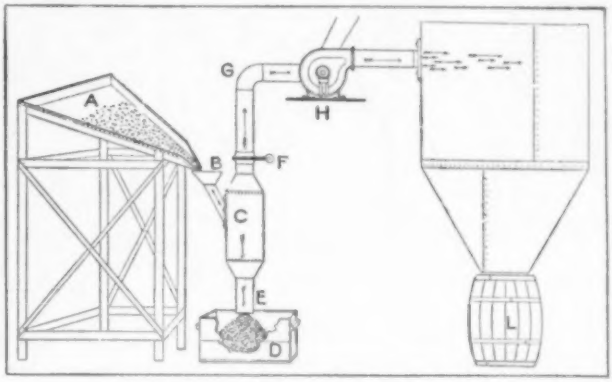


Dissolve 1 lb. of pale glue in 1 pt. of water in a covered vessel heated over a water bath. Allow this to cool and add gradually 3½ oz. of nitric acid. A glue made in this manner is very strong and will not gelatinize. This glue could not be used on some kinds of material on account of so much acid.

REMOVING SAWDUST OR LEATHER FROM TUMBLED ARTICLES

Tumbling is necessary to remove sharp edges and scratches on small metal goods. If it were not for this process they could not be turned out so cheaply. The first tumbling is with gravel to remove the sharp edges and cut down the surface. Steel slugs may also be used for this purpose, says the Brass World. When this operation is completed, the articles are tumbled with leather or sawdust to produce the final finish preparatory to plating.

When the last tumbling is finished the usual method of removing the leather or sawdust is to riddle the articles. A novel apparatus has been provided by one concern to do this separating which is quite a success.



Details of Apparatus for Removing the Leather

The apparatus consists of a trough of wood, A, lined with sheet zinc and inclined toward the funnel B. This trough is to receive the articles as they come from the tumbler and is inclined so that they may be readily pushed into the funnel by hand. The funnel B is rigidly attached to a pipe, C, which tapers down at E. Both the funnel, B, and the pipes, C and E, are made of tin or galvanized iron. The pipe C is about 8 in. in diameter, and E is about 6 in. It is not necessary to have an exact size. On the top of C the pipe is again tapered to 6 in. and a slide blast gate, F, is placed to control the blast. At G the pipe turns and is connected with an exhaust fan, H. This fan may be driven by a belt to a line shaft or direct-connected to an electric motor. The other end of the fan or the exhaust side is connected with a large sheet iron collector of the usual type. This is the well-known appliance used for collecting buffings, sawdust, etc., when an exhaust fan is used.

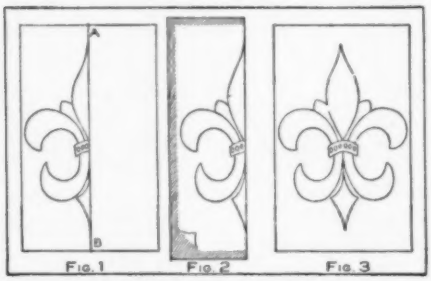
A box or other receptacle, D, is used to catch the cleaned articles. A barrel, L, receives the sawdust or leather. To clean a mixture of small articles and sawdust, it is first dumped into the trough A. This is not inclined so that the articles will slide into the funnel alone, but they must be pushed with the hands. If they all entered at once it would not be possible to clean them thoroughly. As they pass through the funnel B and fall down through the pipe C, the air that is sucked up by the fan removes the sawdust, which is carried over into the collector, and the articles cleaned fall into the box D under the lower end of the pipes.

A Manhole Gasket

About the only manhole gasket that can be used repeatedly with safety is the flat-wire inserted asbestos gasket, says Power. As marking the manhole plate for the purpose is impracticable, it can be done successfully as follows: Leave the gasket adhering to the plate, and do not turn the plate end for end; put the plate in place and tighten the nut with thumb and finger while working the plate until it settles into its proper place, which can be felt. Then a wrench may be applied.

Making Designs with Two Sides Alike

Designs having two sides alike may be accurately made by first drawing one-half the design as shown in Fig. 1 and then fold on line AB. Also fold a

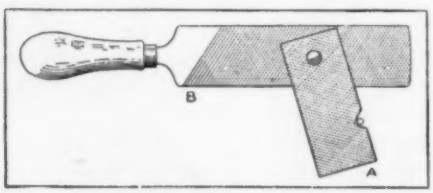


Handy for Leather Workers

sheet of carbon paper, keeping the carbon side out, and place in the fold of the paper as in Fig. 2. Trace the half design drawn with a hard lead pencil or stylus. The back side of the paper will have the complete design, as shown in Fig. 3. This method is especially adapted for workers in leather.

Home-Made Wire Cutter

Any flat file that is worn out can be used to make a wire cutter as shown in the sketch. A short piece, A, is broken off from the end of the file and annealed, so a hole can be drilled in one end and a V-shaped notch cut in the side of it. The larger part, B, is also annealed and a hole drilled in the center and at such a distance from the end to match the one drilled into the short piece. The parts are now tem-



Wire Cutter Made of Old File

pered and riveted together as shown. The wire is placed in the notch and is cut off by striking the piece, A, or this piece may be clamped in a vise and the wire cut by a forward movement of the handle.

Supporting Strength of Barrels

The weight that sound, strong barrels set on end will safely support is beyond ordinary belief. Care should be taken that the barrels have good hoops and rivets employed, that they are set evenly, and the load applied vertically and centrally upon them. Be sure that they do not lean or rock over sidewise, which greatly weakens them. The barrels should stand on a level floor, planks or other reliable floor, with planks or timbers laid across the upper ends, so as to divide the pressure evenly upon the staves.

A mechanical and erecting engineer has so supported 13 tons on two whisky barrels, says a correspondent of Power. A 60-in. by 14-ft., 100-hp. boiler was supported during bricking-in by two whisky barrels, which furnished a cheap, firm support, much more convenient to work around than cribbing, or other means usually employed.

How to Exterminate Moles

When an open hole is found drop into it a piece of cotton saturated with carbon disulphide (carbon bisulphuret), covering it over immediately with earth to keep the fumes down. Carbon disulphide, when exposed to the air, forms a heavy gas, which settles down into the hole and smothers all animal life that may be therein. This is also effective in killing moles and gophers in the garden and field.

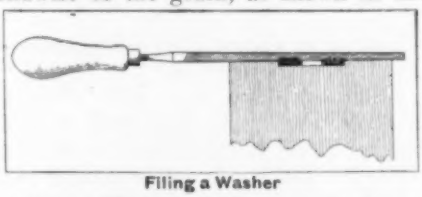
The operator must be careful not to breathe too much of this gas, cautions Florists' Review. In using in the greenhouse put it in at night, so that you will not need to be in the house for a few hours afterward. Also keep the fluid in a well-corked receptacle and away from children. This is sure death for moles and gophers, as it kills every animal in the hole where it is put.

How to Dissolve Glass

A hole may be cut or etched through glass readily by using hydrofluoric acid, says Machinery. The acid should be applied in the same way as etching acid, using wax to surround the portion of glass which is to be penetrated. Hydrofluoric acid is sold in wax bottles, as it cannot be kept in glass. It may be handled with a hard rubber dropper similar in construction to the ordinary glass medicine droppers.

Filing Washers to a Special Thickness

One of the items most often required in the garage is a washer of a particular size and thickness, and as often as not it proves that what one exactly requires is not to be found, says Motor. A washer of a certain thickness is often wanted, for instance, to take up a small amount of backlash or end-play in a shaft. In a case of this kind secure a washer thicker than required and carefully file it down. To file a washer sounds easy, but, handled in the ordinary way, is a difficult thing to do. If one tries to grip it in the vise by the edge it either springs out or rocks in an annoying manner. The operation is made easy if the washer is first pressed between the jaws of a vise into the surface of a piece of soft wood endwise of the grain, as shown in the



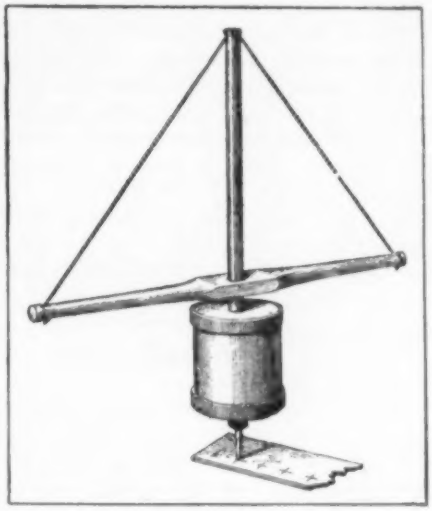
Filing a Washer

sketch. When filing, the wood and metal are cut away together, and if one can handle the file at all well the washer can be removed from its bed as true and as thin as may be desired.

The horsepower of an engine can be found by the following rule: Square the diameter of the cylinder and divide by two.

Home-Made Drilling Machine

It will be seen from the sketch that the drilling machine is a very simple affair, consisting essentially of a round block of wood, about 8 in. long and 8 in. in diameter, with an iron band ring



Simple Drilling Machine

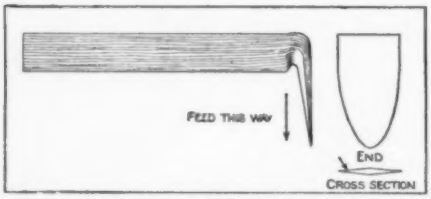
placed on the top and bottom to prevent splitting. Through its center and protruding about 2 in. below is a smooth round wooden shaft about 1¼ in. in diameter and 3 ft. in length. Both ends of this shaft are protected from splitting by a ring or ferrule. The crossbar is a piece of wood about 3 in. wide, 1 in. thick and 3½ ft. long, having a hole in the center large enough to allow the bar to move easily up and down on the shaft and shaped as shown. The ends of the bar may also be protected by ferrules. A hole is bored in each end of the bar and also in the upper end of the shaft. Through these holes a piece of strong cord or rawhide is passed and drawn tight, with a bar standing, squared, about 1 in. above the block. The cord is then secured from slipping in the holes by means of knots and pegs driven in the holes, says the Metal Worker. A drill is inserted in the end of this shaft below the block, and may be made from an

old hand saw file ground to a triangular point.

To set the machine in motion, place the point of the drill on the spot where a hole is to be made, with the machine in an upright position, and while grasping the bar in one hand, with the other turn the shaft around until the bar is raised as high as it will go. Then lay hold of the bar with both hands and press quickly downward. The weight of the block gives sufficient motion to wind up the cord and raise the bar again, when a second downward motion of the bar causes a revolution in the opposite direction. In this way the work is accomplished by pressing down on the bar and allowing it to rise again as the cord winds and unwinds upon the revolving shaft.

A Tool for Turning Rubber

Many mechanics have had occasion to turn rubber and it is safe to say that all have had trouble with, at least, the first attempt. The tool which is shown in the sketch is all that is needed to

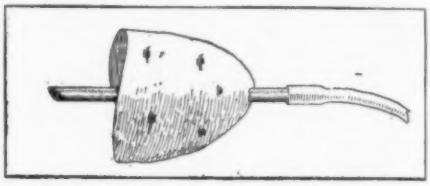


Rubber-Turning Tool

get results on such work. As can be observed, by reversing the tool it can be used either right- or left-handed, always feeding the pointed end toward the work. The tool is given no clearance between the cutting edge and the work. It is really given the opposite action, for the revolving rubber should bear against the tool about as shown by the arrow in the cross section sketch, the elasticity of the rubber being sufficient to induce a cut. This tool should be kept with a very keen edge and not run wet, as in the case of cutting rubber with an ordinary knife. A tool very similar to this can be used on felt, only it will need to have an edge like a razor.—D. A. H.

Pipe Repair on an Automobile Gas Tank

The old adage, "Necessity is the mother of invention," proved itself true in the case of a correspondent of Motoring, who found himself and party on a country road several miles from home one evening, unable to light the lamps on his automobile. The connection between the gas tank on the rubber tubing was found to be missing. A temporary repair was made as shown in the sketch.



Crude, But Useful Emergency Connection

It consists of a stem from a clay pipe (obtained from a passing friend) and a potato. One end of the potato was cut off and the stem of the pipe pushed through the center. The rubber connection was placed over one end of the pipestem and the other end inserted in the gas tank and the potato pressed in tight and tied. The connection thus made proved sufficiently tight to make the flow of gas and keep the lamps burning until home was reached.

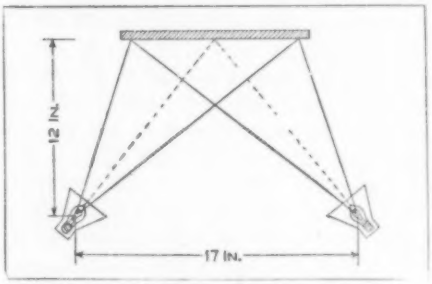
How to Clean Dirty Chamois

Washing is the best way of cleaning a dirty chamois leather, says the Canadian Jeweler, but it is sure to come out stiff and hard unless special care is taken to prevent it. Use common soda, soft soap, and preferably soft water. First rub the soap well into the leather and allow it to remain for a couple of hours in weak, warm soda water. Then wash until clean. Instead of rinsing in clean water and removing all trace of soap, rinse in weak, soapy soda water such as was used for washing in the first place. It is the soap left

in the leather from the rinsing solution that keeps it soft and smooth. After rinsing, wring out the leather in a coarse towel and dry quickly; then brush well, and pull and rub it thoroughly in the hands. If you follow this method carefully your leather should come out as soft and pliable as when new.

How to Illuminate Test Type Charts with Artificial Light

In the numerous small cities and towns glasses are sold by the local jeweler, and in many instances he does not have a complete apparatus for testing the eyes, says the Optical Journal. The accompanying illustration shows a scheme that can be used to illuminate a chart 10 by 25 in. by using artificial light. The reflectors around the globes are placed 17 in. apart and 12 in. back from the placard and pointing in the direction shown. This will give even illumination and at the same time entirely hide the light from the person's

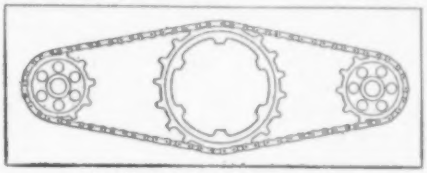


Used in Testing Eyes

eye that is being examined. The reflector should be painted with aluminum paint on the inside and black or green on the outside. Four 8-cp. lamps should be used on each side for best results.

An Idler Wheel for a Long Chain Drive

A chain drive may be used in some places to better advantage than a shaft drive. On long drives the chain will cause trouble unless several idlers are used to keep the links from dragging. Cromwell Dixon, the young aeronaut, has overcome this trouble by using a spokeless idler in between the drive and driven sprocket. This middle wheel is considerably larger than the other two

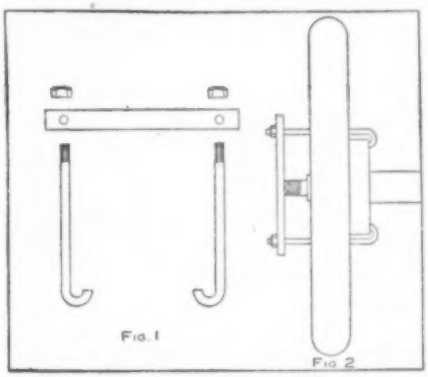


Idler Keeps Links from Dragging

and has no spokes or hub, the position being maintained by the chains going in opposite directions. The accompanying sketch shows the relative positions of the wheels.

A Tool for Removing Automobile Wheels

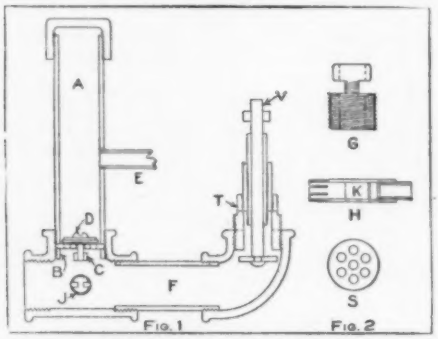
Automobile wheels are not always easy to remove, but by using the device as shown in the sketch they may be removed without much trouble. The device consists of a bar of metal, a little longer than the hub of the wheel, with a hole drilled near each end. Two pieces of ⅝-in. round iron are cut with threads on one end and a hook formed on the other end of each, and of such a length as to equal the distance from the



back of the hub to the end of the axle, allowing for the thickness of the bar and nuts. Details of the device are shown in Fig. 1 and its application in Fig. 2.

Home-Made Hydraulic Ram

A hydraulic ram may be used in a fall of water that is 4 ft. or over to elevate water to a higher level. The construction of such a ram is very simple and can be made from pieces of pipe and fittings. Galvanized parts should be used in its construction if possible, and all joints put together with white lead or graphite.



Made of Pipe and Fittings

The accompanying illustration shows the parts in cross section. The pipe used for a 4-ft. fall should be ¾ in. The pipe A, Fig. 1, is about 6 in. long and fitted with a cap on its upper end. The valve in the lower end of this pipe is held in place between the end of the pipe A and a small ring, B. This small ring is a piece cut from the end of a threaded pipe. The valve seat is a circular disc of hard fiber with several holes drilled around the center hole, as shown at S, Fig. 2. The valve is made by using a brass machine screw, D, put through a hole centrally drilled in a brass disc, which is soldered to the screw. Under this brass disc is fitted a rubber gasket. The valve is kept in place with a small collar, C, soldered to the end of the screw. The outlet pipe, E, is ¼ in. in diameter and is of sufficient length to elevate the water to the point desired. A ¾-in. nipple, F, 2 in. long, connects the elbow, in which is placed another valve. This valve is held in position by a combination of pipe fittings as shown. The valve rod, V, is made of ¼-in. brass and is 3 or 4 in. long, fitted with a brass disc on the lower end and an adjusting nut on its upper end. The valve rod works in a piece of pipe that is threaded to turn through a coupling and project about ⅜ in. The coupling is threaded on the outside to fit the threads in one part of a union, T. This union is fitted into the elbow as shown. A part of the union is cut out, as shown in Fig. 2 at G, to form an outlet for the waste water. A small air valve, H, Fig. 2, is used for admitting a small amount of air at J, Fig. 1, in the ¾-in. tee, which must be drilled and threaded for an ⅛-in. pipe. This air valve is made from an ⅛-in. pipe slotted at one end to form prongs to hold the valve K, which is a piece of hard fiber formed cone-shaped at one end. The other end of the pipe is fitted internally with a smaller pipe, whose end is drilled tapering to form a seat for the fiber valve.

The inlet or drive pipe should be ¾ in. in diameter and at least 20 ft. long and attached to the open end of the tee. The fall of water should be at least 4 ft. and of sufficient amount to keep the pipe full at all times. With a 4-ft. fall, water may be elevated at least 35 ft.

When the ram is in action the water flowing in the inlet pipe flows past the valve in the elbow until it has gained sufficient velocity to close the valve, which brings the column of water in the drive pipe to a sudden stop, or ram, which forces a portion of the water past the small valve in the tee into the air chamber, A. Immediately after the ram takes place there is a reaction or recoil, which allows the valve in the elbow to open, and the action is repeated. Air is supplied to the air chamber through the small valve in the tee at J at every ram of the water.

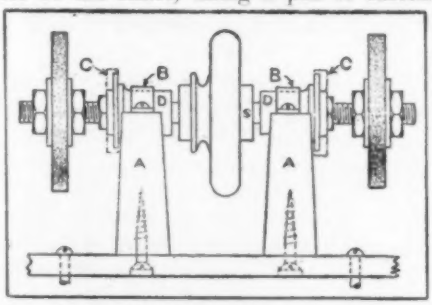
How to Blue Steel

The articles to be blued must be polished very bright and made smooth with fine emery. Prepare some kind of an airtight iron box. A gas pipe of suitable diameter, threaded on both

ends and fitted with caps will answer the purpose. Pack the articles in this airtight receptacle with slaked lime. Heat the receptacle, with the enclosed contents, to a dull red and then allow it to cool. After it is cool remove the articles, which will have a blue that will last for years. Care should be taken that the lime is not damp or any dampness whatever placed in the pipe, as this might cause an explosion.

Home-Made Ball-Bearing Emery Grinder

This emery grinder can be made with very little trouble, the emery wheels being the most expensive item to consider. In the first place secure an old bicycle hub and cut in half and throw away the shaft, as it will be too short. Cut two wooden blocks for standards, AA, cutting a groove in the tops to receive the bearings, or ends of the bicycle hub, DD, which are held in place by bent iron straps, BB. A new shaft is made about 12 in. long, threaded to take the cones about 4 in. from each end; the thread also is used to take the nuts that secure the emery wheels. An old sewing machine wheel and a few washers will complete the grinder. Mount the wheel on the center of the shaft, using a pin to fasten

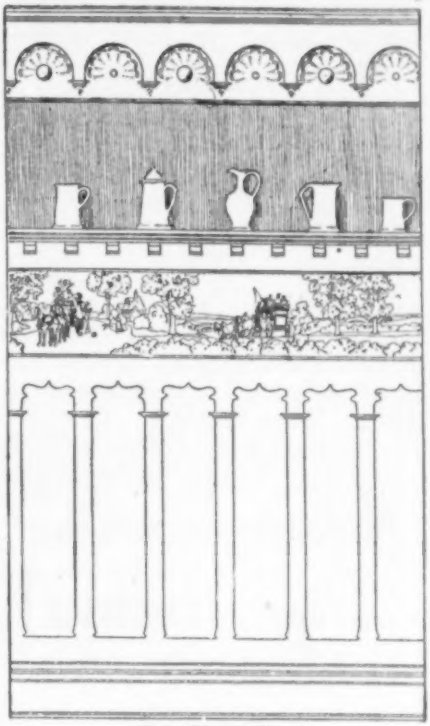


Details of Ball-Bearing Emery Grinder

it, and assemble the bearings. Dust may be kept from the bearings by fastening a tin guard over each one (CC). This emery grinder may be run on an old sewing machine table, says the Model Engineer, by a lathe flywheel or driven by power from a shaft.

Pictorial Frieze Designs

Pictorial friezes can be used in a great many original ways by the decorator who is wide awake to their possibilities. Illustrated herewith is a suggestion in which a coaching frieze is utilized in the decoration of a dining



For a Dining-Room

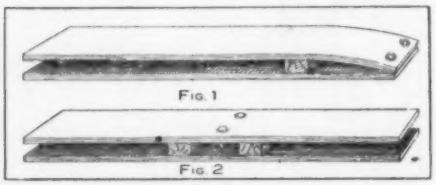
room. The frieze is made in 6-ft. lithographed sections, each is different, and the complete design is 30 ft. long before it repeats. The sections may be used in any order preferred, so there is no continued repetition in the room.

In the decorative treatment illustrated the frieze forms the keynote of the design and is used as the crowning feature of the tall paneled dado, which can be made of wood, or the panels may be filled in with burlap, and the stiling only made of wood. The dado is capped with a shelf molding that serves as a resting place for steins and jugs, the upper portion of the wall being hung with a grass cloth, says the American Carpenter and Builder. The

cornice is made up of a series of arches, with plaster or plastic relief shell ornaments, and under every other arch is an electric light bulb. This cornice should be in ivory white, of the tone of old ivory, the ceiling being somewhat lighter. The wainscot and the other woodwork of the room may be either in forest green or fumed oak, or may be finished in white or ivory enamel.

A Driver's Spring Board Seat

When no spring seat for a wagon is at hand one can be made quickly from two boards 12 in. wide and about 4 in. longer than the wagon box is wide. Place a 2- or 3-in. block between the two boards about 6 or 8 in. from one end, according to the weight of the driver. The boards are securely fastened together at the end nearest the block, as shown in Fig. 1. This forms a spring board seat. If constructed for



Spring Seat for Wagon

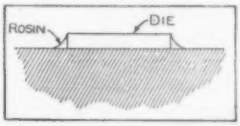
two, place two blocks between the boards near the center and bolt them together, as shown in Fig. 2.—Contributed by E. A. Fishback, Colorado Springs, Colo.

How to Cover an Engine Foundation

To make an unsightly looking engine or pump foundation attractive and neat, take Russian sheet iron, or zinc sheets, and tack them to strips of wood around the foundation as shown in Fig. 1. The frame on which to fasten the metal is made from strips of wood nailed together in the shape shown in Fig. 2. This makes a good looking job, says Power, hiding all defects, dirt, oil, etc., and with a little ingenuity it can be arranged for any shape of foundation.

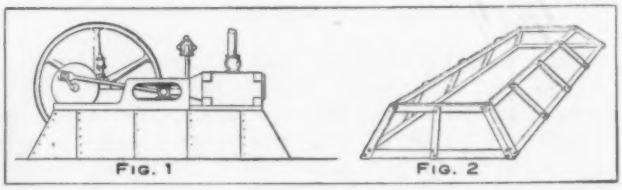
How to Hold Thin Metal While Turning

It is necessary sometimes for the machinist to take a small cut over some thin piece of work that is not safe to hold in the machine in the usual manner. When such work is to be done the method known as "gluing" is used. The piece to be dressed is held against the face plate or table and melted rosin poured around the edge. Shellac will answer for this purpose, but a much better composition is rosin and beeswax. After the cut is taken the material is easily broken off and saved, which can be used repeatedly by applying each time with a soldering iron. Best results are obtained by having all parts free from grease.—Contributed by Donald A. Hampson, Middletown, N. Y.



How to Insert Electric Bell Wires Through Partitions

A good method of putting electric wires through partitions with an open space between walls for bell wiring is to provide a $\frac{3}{16}$-in. iron rod about 15 in. long and drill a number of $\frac{3}{32}$-in. holes through one of the ends. Drill the holes, commencing about 2 in. back from the end, about $\frac{1}{2}$ in. apart and in



A Neat Engine Foundation

a spiral around the rod. Pass the ends of the wires through the holes and turn back about 2 in. of the ends. Pass the rod through the hole bored in the partition and pull it out from the opposite side.

How to Paint Automobile Mufflers

The muffler and exhaust piping of an automobile can be painted with a paint made as follows: Boiled linseed oil, 1/5 lb.; japan varnish, 1/5 lb.; spirits of turpentine, 2/5 lb.; lampblack, 1½ oz.; pure powdered graphite, 1½ oz.; powdered oxide of manganese, ⅜ oz. First mix the linseed oil and the japan varnish well together, then add in the order named, and stirring all the time, the lampblack, graphite and powdered manganese. The solids should be added slowly while the stirring is briskly maintained. As the mixture thickens, thin it down with the turpentine, until the quantity mentioned is added. This paint should be used at once, for it dries rapidly and every time the brush is dipped the mixture should be carefully stirred. It is well to paint the mufflers while they are hot, first cleaning them thoroughly.

Blown Joints in Water Pipes

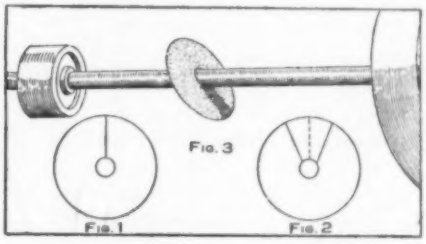
In a paper read before the American Water Works Association the following experiences with blown joints are given:

"A line of water pipes passed under the railroad tracks in our distributing system and the joint came directly under one rail. This joint was partially blown out several times and had been recorked. We were unable to keep it tight, and finally were compelled to take it out and place a full length under the track, so as to bring the joints of pipe between the tracks, or what is generally termed in railroad language as a 'fire foot' between each set of tracks. After doing this we experienced no further trouble from this particular joint, after some four years of use.

"In a similar case where we had a leaking joint under the rail, after trying many ways to repair it, we finally resorted to the use of lead wool and after making the repairs we found it to remain in good shape for about one year, indicating that a blown-out joint can be more successfully repaired with lead wool than with cold lead corked in."

How to Keep Line Shaft Clean

In many places overhead line shafting must be kept clean and free from any oil that may form in drops and be thrown by the motion of the shaft. The sketch shows how to construct a device



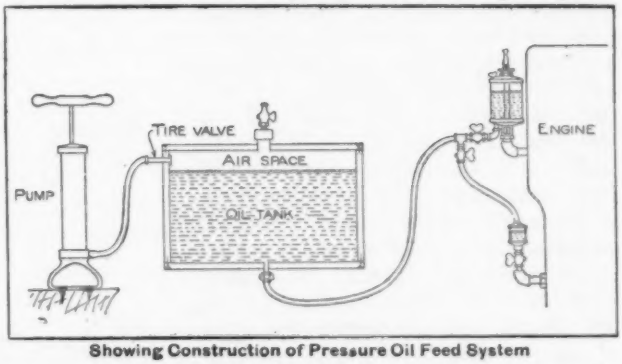
Pasteboard Disc Keeps Shaft Clean

to place on shafting between pulleys or bearings to keep the shaft clean. A piece of pasteboard is cut circular, from 12 to 16 in. in diameter, for small shafting, with a hole in the center a little larger than the shaft on which it is to be used. This ring of pasteboard is cut from the edge to the center hole, as shown in Fig. 1, to make an opening to slip the ring over the shaft and then held together by a piece of heavy paper glued on the face over the cut, as shown in Fig. 2. The ring or disk of pasteboard is shown in position on the shaft in Fig. 3. When the shaft is turning the disk will slowly travel from one wheel to another and then change position and return back over the shaft. This will keep the shaft clean from dirt and grease.

How to Make a Pressure Oil Feed System

By Harry Bayer in Motor Boat

Secure a gallon can from a paint store, such as used for paint or varnish will serve the purpose, as the pressure required will amount to only a few pounds. Remove the handle from the can and cut off the cap from which the paint was to be poured. An ordinary bicycle tire valve is fastened to a piece of tin which is soldered to the hole where the opening was made in the can by cutting off the cap. This will be at the top of the can when it is placed on one of its narrowest sides, and when in place the valve will be above the oil. Solder an ⅛-in. brass nipple in the bottom of the can for an oil outlet. A piece of tubing threaded at one end for a cap is soldered in the top of the can to serve the purpose of filling the tank. A good plan is to purchase a small cock, tap the cap and screw the cock in so that the tank may be left open when it is not in use.



Showing Construction of Pressure Oil Feed System

The tank is now enclosed in a wooden box. The box can be made in any manner or kind of wood to suit the builder. It is best to enclose the tank in a wooden box, as the air pressure is likely to force it out of shape, and anyway the wooden covering gives it a much neater appearance. An ordinary bicycle foot-pump was cut down to about 4 in. in length, to be used for the air pump. The pump is fastened wherever most convenient with screws through the foot-piece.

The oil cups are lapped at the top or bottom for an ⅛-in. nipple. The remainder of the outfit consists of brass tubing, which costs a trifling sum. It is necessary to anneal the tubing first, after which it can be bent in any shape when soldered. The tubing is soldered into the fittings wherever possible. Unions should be used only when necessary. The tank can be put in any out-of-the-way place.

An Ammeter Trouble

In a private lighting plant there was an ammeter which was supposed to show the total current drawn from the lighting bus. There was also a similar ammeter to show the current drawn from the power bus. The lighting bus ammeter readings did not agree, by several hundred amperes, with the sum of the readings of the individual ammeters of the generators connected to the bus, and before the cause was discovered and remedied, it had the engine room force, a good portion of the owners' engineering department and the makers of the instrument guessing for several months.

Comparison of the generator ammeters, singly and collectively, with the power bus ammeter indicated that these instruments were very nearly correct, so the lighting bus ammeter was blamed for the trouble and sent back to the maker to be overhauled, says the Electric Journal. In a week or two the instrument was re-installed and found to be no nearer correct than before, so it was again returned to the maker. This time the maker reported that there was nothing the matter with it and sent in a bill for overhauling and recalibrating it. The owners stated the facts and refused to pay the bill. The instrument maker's engineer then called upon the engineer to whom the

matter had been referred and suggested that a wrong connection was probably the cause, but an examination of the wiring diagram of the switchboard disclosed none. He then suggested that possibly a stray field was the cause and together with an assistant of the owners' engineer examined the back of the switchboard for wrong connections and stray fields; but they didn't notice any, and gave it up.

The lighting bus consisted of four bus-bars; positive, negative, and equalizer (to which the generators were connected by means of three-pole switches) and a fourth bar to which the feeder circuit breakers were connected. In the connection between the plus bus-bar and this fourth bar, the shunt of the offending ammeter was connected.

It was finally discovered that a new feeder which had been installed to reenforce an old feeder was connected to the plus and minus generator bus-bars above the ammeter shunt, instead of to the fourth or feeder bar and the minus bus-bar as it should have been. When this was corrected, the trouble disappeared, and the instrument maker's bill was paid with apologies.

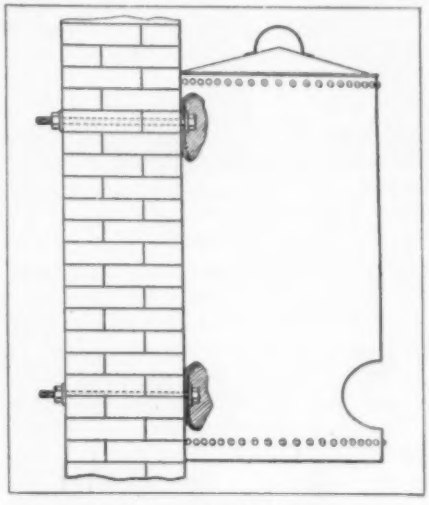
Gasket for a Gasoline Engine Cylinder Head

If you have had the misfortune to get the exhaust chamber face or cylinder head casting of your gasoline engine sprung or cracked until the common asbestos gasket will not hold, the following method will prove of service until repairs can be obtained: Get some asbestos fiber that is used for covering steam pipes and add about one-third to one-fourth more than the usual amount of plaster of paris and mix into a stiff paste with water. Spread this mixture evenly over the surface of the head and quickly bolt the head in place. Allow the composition to set until it hardens before starting the engine.

The paste fills all the inequalities of the two surfaces when the nuts are turned down tight, and when set it makes a very good gasket for temporary use.

Water Boiler Used for a Waste Holder

The accompanying sketch shows how an old water boiler was put into service as a waste holder. The top was removed by cutting the rivets and a small hand hole cut in one side of the boiler. Two holes were drilled in the other side of the boiler to admit bolts which were used to fasten it to a wall. When painted with aluminum paint and filled with 50 lb. of waste it made a splendid addition to the plant, says a correspondent of the Practical Engineer. This makes a mice-proof, fireproof and water-proof receptacle.



Handy Waste Holder for Plant

Checking Corrosion in a Boiler

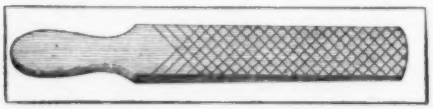
One of the best methods of checking corrosion in a boiler is to have zinc plates hung in it, says Power. Attach them to the tubes and braces. The galvanic action will then eat the zinc instead of the boiler. Especially is it necessary to use zinc if there is a surface condenser in the plant. The brass tubes of the latter set up an action that

is liable to ruin a boiler in a few months, if something is not done about it.

A Substitute Whetstone

The sharpener is made from a piece of soft ash or white cedar, tapered from ⅜ to ¼ in. in thickness, 2 in. wide and 18 in. long. A handle is shaped on one end and cross cuts are made in each surface with a knife, as shown in the sketch.

Old broken glass is pounded fine with a hammer. This is done in a



Made of Soft Ash or White Cedar

shovel or other convenient receptacle. The fine glass is put in a bottle for occasional use. Ham fat, or any kind of grease, is spread on both sides of the stick and the fine glass sprinkled on and well spread over with a knife.

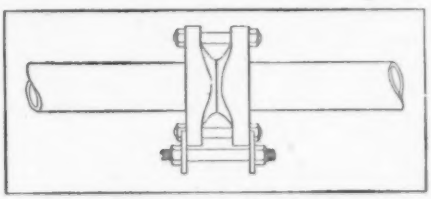
The more the sharpener is used the better it gets, as the tool being sharpened presses the glass well into the grease and wood, forming into a hard paste. The tool is first ground, and then a keen edge put on it with the sharpener, which is more satisfactory than when done with an ordinary hand stone sharpener, the edge being smooth like that of a razor, instead of resembling a saw cut. This sharpener is especially adapted for use on scythes and sickles.

Stopping Leaks in Water Pipes

The usual method of stopping a small leak in a lead pipe is to close up the hole by hammering its edges together, but such repairs are apt to give way in time and be as bad as ever, says Woodworkers' Review. The following method was applied to a lead pipe in which half a dozen pin holes had been cut through so that there was a perfect spray coming out. The water having been turned off, a few strips of very strong muslin were provided, about 1 in. wide; these were coated on one side with plaster of paris mixed with water, as if for taking casts, and wrapped around the pipe, with the plaster coating inside, for three or four thicknesses. They were then bound firmly with fine linen twine and allowed to stand for three or four hours, so that the plaster might set before the water was turned on again. The repair shows no sign of giving out.

Repairing an Ammonia Pipe Joint

There was a ½-in. union on a liquid ammonia line that gave considerable trouble, says a correspondent of Power. The bolts had been taken up until there was no thread left and still the joint leaked. It was impossible to shut off the line at that time, so the joint was repaired as shown in the sketch. By using a ¾-in. bolt with the thread long enough to go across the flange, and a



Repair for Leaky Joint

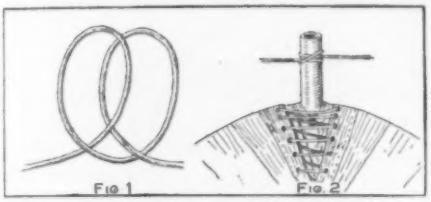
heavy washer on both ends, the flange was held tight so that washers were put under the nuts, one at a time, which allowed the nuts more space to be tightened and the joint closed, thus stopping the leak.

Covering the boiler setting with a layer of asbestos cement, passing over this a canvas, and painting the whole with a heavy coat of paint, is said to effect a saving of 12.5 per cent of the coal bill. It is also stated that thoroughly coating the brick work with red paint so as to fill the pores will cause a considerable saving of fuel in almost any boiler.

Amateur Mechanics

Tying a Knot for Footballs

One of the most prominent English football clubs kept the tying of this knot on the rubber hose of their football a secret and never allowed all of its members to know how it was tied. This tie can be used on grain sacks

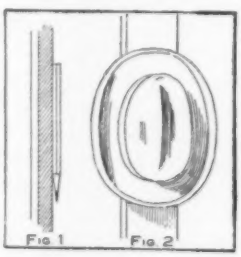


A Secure Knot

and numerous other similar instances. Make one loop in the cord and then another one exactly the same way, as shown in Fig. 1, placing the end of the cord under the first loop then pull at each end of the cord as in Fig. 2.—A. E. J.

Hang Your Hat on a Lead Pencil

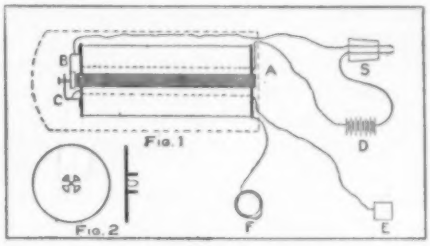
Take a smooth hexagon lead pencil, one without either rubber or metal end, and place it against a door or window casing; then with a firm, heavy pressure slide the pencil some 3 or 4 in. and it will stay as if glued to the casing. You may now hang your hat on the end of the pencil.



When you slide the pencil along the casing, do it without any apparent effort and it will appear to your audience as though you had hypnotized it. This is a very neat trick if performed right. Fig. 1 shows the pencil on the casing and Fig. 2 the hat hanging on it.

How to Give an Electric Shock While Shaking Hands

To receive an electric shock while shaking hands is quite a mystery to your friends. This may be accomplished with the aid of a small induction coil that can be constructed at home. The core, A, Fig. 1, is constructed in the usual manner with small soft iron wire to make a bundle about $\frac{3}{16}$ in. in diameter and about 2 in. long. The coil ends are made from cardboard about 1 in. in diameter with a $\frac{3}{16}$-in. hole in the center. When cutting the hole, cut it as shown in Fig. 2, so as to have four small pieces that can be bent out, leaving the projections as shown. After wrapping three or four turns of paper around the bundle of



Details of Induction Coil

wires the cardboard ends are put on with the projections inside, so the coils of wire will hold them in place. About 70 turns of No. 24 double-covered magnet wire is first placed on the core for the primary and then 1,500 turns of No. 32 or 34 double-covered wire is wrapped on top of the primary for the secondary. Sufficient length of wire must be left outside from each end of both windings to make connections. The vibrator, B, Fig. 1, and the support, C, are made from thin spring steel about $\frac{1}{8}$ in. wide, bent as shown and securely fastened to the cardboard end of the coil. The armature is made from a soft piece of iron about $\frac{3}{16}$ in. in diameter and $\frac{1}{16}$ in. thick, which is

soldered to the end of the vibrator directly opposite the end of the core. A small screw is fitted in the end of the support, C, for adjustment, which should be tipped with platinum and also a small piece of platinum placed where the screw will touch the vibrator, B.

One of the primary wires is connected to the screw support. The vibrator is connected to a flash lamp battery, D. The other primary wire is connected to a switch, S, which in turn is connected to the other terminal of the battery. The switch, S, may be made from a $\frac{3}{8}$-in. cork with the wires put through about $\frac{3}{16}$ in. apart and allow them to project about $\frac{1}{2}$ in. The plate E is cut about $\frac{1}{2}$ in. square from a piece of copper and is fastened to the heel of one shoe and connected with a wire from the secondary coil which must be concealed inside of the trouser leg. The other secondary wire is connected through the coat sleeve to a finger ring, F. The vibrator screw must be properly adjusted. When the vibrator is not working the armature should be about $\frac{1}{16}$ in. from the core and directly opposite.

The coil when complete will be about $2\frac{1}{2}$ in. long and 1 in. in diameter. The coil can be placed in an old box that has been used for talcum powder or shaving stick. The space around the coil in the box can be filled with paper to keep it tight.

The coil and battery are carried in the pockets and the cork button put in the outside coat pocket, where it can be pressed without attracting attention.

Experiment with Heat

Place a small piece of paper, lighted, in an ordinary water glass. While the paper is burning turn the glass over and set into a saucer previously filled with water. The water will rapidly rise in the glass, as shown in the sketch.

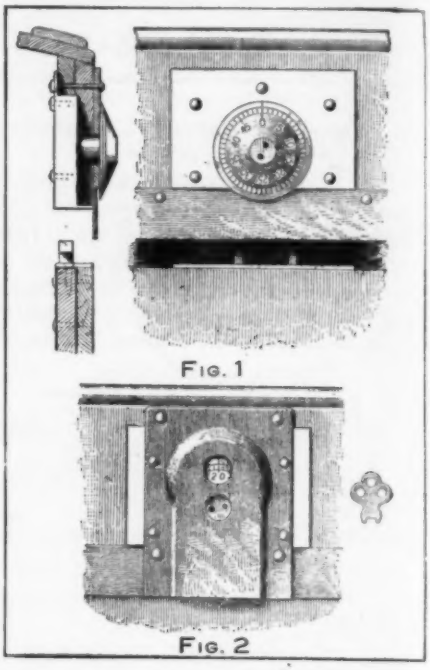


FIG. 1

FIG. 2

How to Attach a Combination Trunk Lock

A small combination lock for chests can be purchased for a small sum of money and attached to a trunk cover after first removing the old lock as shown in Fig. 1. It is necessary to add $\frac{1}{2}$ in. to the thickness of the trunk lid or cover. This may be done by placing a brass plate $\frac{1}{8}$ in. thick on the outside and a board $\frac{3}{8}$ in. thick on the inside. The lock, brass plate, board and trunk cover are all securely riveted together. The support for the dial is soldered to the brass plate.

The hasp, if that be the name for the double toothed arrangement that catches into the lock, was to be secured by only three brass screws, which seemed to be insufficient, says a correspondent of the Metal Worker; therefore a piece of heavy tin was formed over the front of the trunk, which is only $\frac{3}{8}$-in. board, the hasp tinned and soldered to the back of the now U-shaped tin, and the tin placed over the board and all fastened in posi-

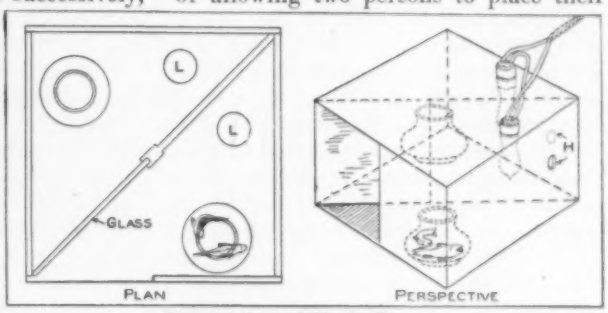
tion. The tin is 4 in. wide, 16 in. long and when placed over the board, it laps down about 8 in. between the boards, and the same distance inside of the new board, as shown by the heavy line in the cross section, Fig. 1. Wrought nails are used which pass twice through the tin and both boards, and then well clinched. The three screws were then put in the hasp.

The knob on the dial extends out too far, which may be filed off and two holes substituted, as shown, with which to operate the dial. An old key is filed down in the shape shown in Fig. 2 to fit the two holes.

As the dial is convex it will need protection to prevent injuiry by rough handling. A leather shield may be used for this purpose, which is cut with two holes, one for the key and the other to permit the operator to observe the numbers on the dial. The shield answers a further purpose of preventing any bystander from noting the numbers on the dial.

AN ELECTRIC ILLUSION BOX

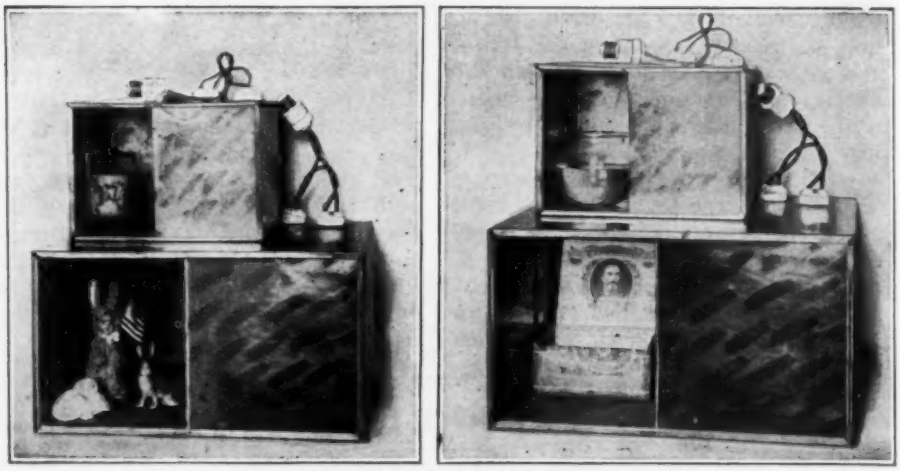
The accompanying engravings show a most interesting form of electrically operated illusion consisting of a box divided diagonally and each division alternately lighted with an electric lamp. By means of an automatic thermostat arranged in the lamp circuit causing the lamps to light successively, an aquarium apparently without fish one moment is in the next instant swarming with live gold fish; an empty vase viewed through the opening in the box suddenly is filled with flowers, or an empty cigar box is seen and immediately is filled with cigars.



Construction of Magic Boxes

These electric magic boxes as shown are made of metal and oxidized copper finished, but for ordinary use they can be made of wood in the same shape and size. The upper magic boxes as are shown in the engraving are about 12 in. square and 8½ in. high for parlor use and the lower boxes are 18 in. square and 10½ in. high for use in window displays. There is a partition arranged diagonally in the box as shown in the plan view, which completely divides the box into two parts. One-half the partition is fitted with a plain, clear glass as shown. The partition and interior of the box are rendered non-reflecting by painting with a dull, not shiny, black color. When making of wood, a door must be provided on the side or rear to make changes of exhibits. If the box is made large enough, or in the larger size mentioned, openings may be made in the bottom for this purpose, and also used in case of performing the magic trick of allowing two persons to place their heads in the box and change from one to the other.

The electric globes are inserted as shown at LL through the top of the box, one in each division. When the rear part is illuminated, any article arranged within that part will be visible to the spectator looking into the box through the front opening, but when the front part is illuminated, and the back left dark, any article placed therein will be reflected in the glass, which takes the same position to the observer as the one in the rear. Thus a plain aquarium is set in the rear part and one with swimming fish placed in



Four Electric Magic Boxes Complete for Use

the front, and with the proper illumination one is changed, as it appears, into the other. When using as a window display, place the goods in one part and the price in the other. Many other changes can be made at the will of the operator.

Electric lamps may be controlled by various means to produce different effects. Lamps may be connected in parallel and each turned on or off by means of a hand-operated switch or the button on the lamp socket, or if desired a hand-operated adjustable resistance may be included in the circuit of each lamp for gradually causing the object to fade away or reappear slowly.

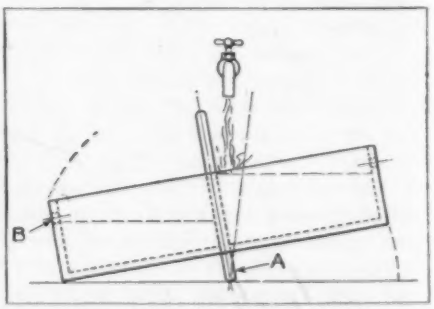
Instead of changing the current operated by hand, this may be done automatically by connecting the lamps in parallel on the lighting circuit and each connected in series with a thermostatic switch plug provided with a heating coil which operates to automatically open and close the circuit through the respective lamp.

When there is no electric current available, matches or candles may be used and inserted through the holes H, as shown in the sketch, alternately.

Painting over putty that has not become dry will cause scaling or cracking around the edges of the putty.

Photo Print Washing Tank

The accompanying sketch shows a simple form of a print washing tank that tips from side to side by the weight of the water. For prints 4 by 5 and 5 by 7 in. a tank 2 ft. long and 1 ft. wide will be about the right size. This tank is then divided with a partition placed exactly in the center. This partition should extend 3 or 4 in. above the top of the tank. The partition may also extend below the tank about 1½ in., or a piece of this width put on the bottom, as shown at A in the sketch.



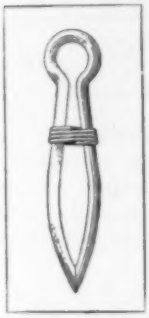
Keeps Prints Constantly Moving

A row of holes about ½ in. in diameter is bored through each end of the tank, as shown at B. These holes will allow the water to spill out while the opposite side is filling. The tank may be made from ½-in. material and when

completed as shown, lined with oil cloth to make it watertight. The tank is placed with the partition directly under a water tap and the flow of water will cause it to tip from time to time, keeping the prints constantly moving about in the water.

Home-Made Soldering Clamps

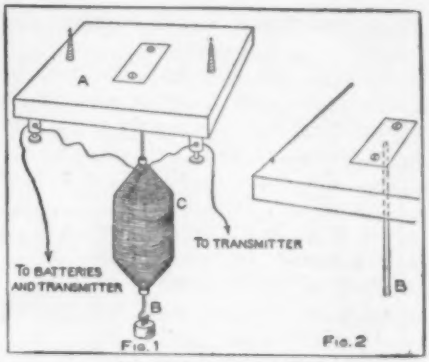
Take a cotter pin and bend it over a small rod to bring the points together, as shown in the sketch. This will make a spring clamp that is opened to slip over the articles to be clamped together by inserting a scratch awl or scriber between the legs at the bowed portion. To make a more positive clamp before bending the legs to a bow, slip a short coil of wire over the pin, passing it down to the ring end. Wire $^1/_{32}$ in. in diameter wound over a wire slightly larger in diameter than that of the cotter will do. In soldering, smoke the legs well to avoid solder adhering to them. The clamp is tightened by pushing up the coil ring toward the bow of the legs and then twisting it like a nut, the coil being wound right-handed, so that it will have a screw effect.



A Telephone Experiment

If the small apparatus, as shown in the accompanying sketch, is attached to the under side of an ordinary dining table, it will, if connected to a telephone circuit, set the table in vibration, so that any number of people who put their ears flat upon the table will hear the voice of a person speaking from a distance, apparently coming out of the table, says the Model Engineer.

A small piece of wood, A, Fig. 1, is cut about 5 in. square, to the center of which is attached a small piece of soft iron wire, such as used for cores



Mechanical Table Talk

of induction coils, about 4 in. long and bent in the form of a hook at the lower end, as shown at B. This wire is attached to the block of wood, A, as shown in Fig. 2. The end of the wire is soldered to a small brass plate which is set in the block so it will be level or flush with the top of the block and then fastened with two screws. The block A is fastened to the under side of the table with two screws. A small coil, C, is made by winding No. 24 silk or cotton covered wire around a small tube, either a piece of glass, a short straw or a quill. The coil is made tapering as shown without using wood ends. This coil is slipped over the wire B previous to soldering it to the small brass plate. The ends of the coil are connected to two binding-posts which are fastened to the block A. A small lead weight weighing 2 or 3 oz. is hung on the hook made in the lower end of the wire B.

When all connections are made, as shown in Fig. 1, and the block fastened to the under side of the table, the apparatus is ready for use, and has only to be connected to an ordinary telephone transmitter and batteries as shown. The apparatus will work to a certain extent even if the weight is removed, though not so clear.

Some workmen use tallow on lag or wood screws. Try beeswax for this purpose. It is much cleaner to use and is just as good if not better.

How to Make an Induction Coil

A small shocking coil, suitable for medical purposes, may be constructed of materials found in nearly every amateur mechanic's collection of odds and ends. The core, A, Fig. 1, is a piece of round soft iron rod about ¼ in. in diameter and about 4 in. long. A strip of stiff paper about ¾ in. wide is covered with glue and wrapped around one end of the core, as shown at B, until the diameter is about ⅝ in. The portion of the core remaining uncovered is then wrapped with a piece of paper about 4 in. wide. No glue is used on this piece, as it is removed later to form the space, C, after the paper shell, D, has been wound upon it. This paper shell is made of stiff paper and glue the same as B and is made about 3/64 in. thick. Two pieces of hardwood, EE, 1¾ in. square and about $\frac{5}{16}$ in. thick, are drilled in the center and glued on the ends of the paper shell as shown.

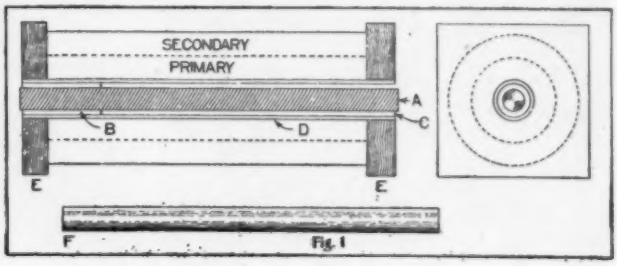


Fig. 1

The primary winding consists of 4 or 5 layers of No. 18 or 20 single cotton-covered magnet wire, the ends of which may be passed through small holes in the wooden ends. If a drill small enough is not available, the holes may be made with a hot knitting needle or a piece of wire heated to redness. After the primary coil is wound it should be thoroughly insulated before winding the secondary. This may be done by wrapping with 4 or 5 thicknesses of paper.

The secondary coil should be wound with single covered wire, preferably silk-covered, although cotton will do. The more turns there are on the secondary the higher the voltage will be, so the wire used must be fine. Number 32 to 36 will give good results, the latter giving more voltage but less amperage. Each layer of the secondary winding should be insulated from the others by a piece of thin paraffined paper wrapped over each layer as it is finished. It is well not to wind to the extreme ends of the paper insulations, but to leave a space of about ⅛ in. at each end of the winding to prevent the wires of one layer slipping over the ends of the paraffin paper and coming in contact with the layer beneath, thus causing a short circuit. The secondary winding should have at least a dozen layers and should be carefully wound to prevent short circuiting.

In order to reduce the strength of the current a piece of brass tubing, F, is pushed into the space, C, surrounding the core, or if no brass tubing of the required size is on hand, roll a paper tube, cover with 4 or 5 thicknesses of tinfoil and then wrap with more paper, using glue to hold the tinfoil in place and to keep the tube from unwinding. When the tube is pushed all the way in, the current produced will be almost unnoticeable, but when it is withdrawn the current will be so strong that a person cannot let go the handles until the coil is shut off. After the secondary coil is wound it should be covered with stiff paper, and the whole coil, including the wood ends, should then be enameled black.

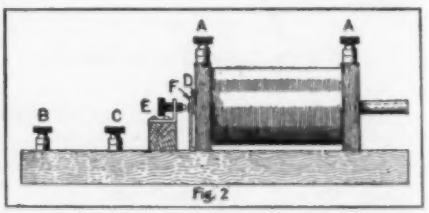


Fig. 2

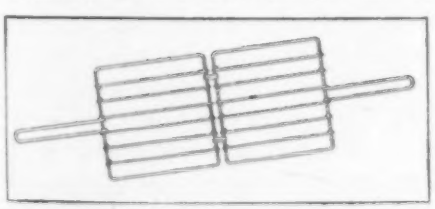
It is then ready to be mounted on a wooden base as shown in Fig. 2. The

secondary terminals are connected to the binding-posts, AA, which may be fastened on the base if desired. One wire from the primary is connected with the binding-post, B, and the other is connected with the armature, D, which may be taken from an old electric bell. The contact screw, E, also from an electric bell, is connected to the binding-post, C. The contact spring, F, should be bent against and soldered to the armature in order to make the vibrations more rapid.

If a false bottom is used on the base, all the wiring may be concealed, which adds greatly to the appearance, and if desired a small switch may be added. The handles, which may be old bicycle pumps or electric light carbons, are connected to the binding-posts, AA, by means of wires about 3 or 4 ft. long. This coil when operating with the tube pulled all the way out and connected to a single dry cell will give a current stronger than most persons can stand.

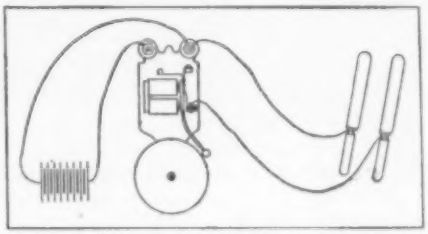
Home-Made Toaster

Each outside frame of the toaster is made from one piece of wire 30 in. long. These are bent in a perfect square making each side 7 in. long. This will allow 1 in. on each end for tying by twisting the ends together. The first two wires inside and on each side of each frame are 8 in. long. Eight wires will be required for this purpose and as they are 8 in. long ½ in. is allowed on each end for a bend around the outside frame, as shown in the sketch. The two middle wires are extensions of the handles. Each of these wires are made from a piece about 26 in. long and bent in the shape of a U. The ends of the wire are bent around the frame in the same manner as the other wires. This will leave the handle laying across the other side of the frame. The frame is fastened to the handle on this side by giving the handle one turn around the frame. The inside edges of the frame are now tied together with a small ring of wire which is loose enough to allow each half to swing freely.—C. D. M.



Home-Made Shocking Machine

An ordinary electric bell may be connected up in such a way as to produce the same results as an expensive



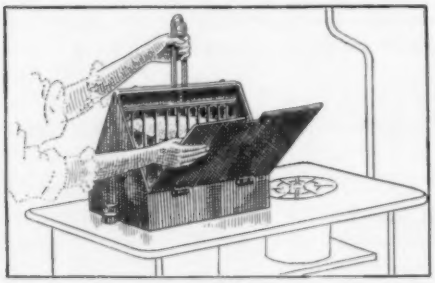
Inexpensive and Effectual

shocking machine. The connections are made from the batteries to the bell in the usual manner. Two other wires are then connected, one to the binding-post of the bell that is not insulated from the frame and the other to the adjusting screw on the make and break contact of the bell as shown in the sketch. The other ends of the wires are connected each to a common table knife. This will give quite a good shock and a much larger one can be had by placing one knife in a basin of water and while holding the other knife in one hand, dipping the fingers of the other hand in the water.—Contributed by D. Foster Hall.

Mix venetian red with quite thick arabic muscilage, making it into a putty, and press this well into the cracks of mahogany before finishing. The putty should be colored to suit the finish of the wood, says the Master Painter, by adding such dry color to the gum as will give the best result.

DUPLEX BROILER AND TOASTER FOR GAS STOVES

The duplex broiler and toaster here shown was designed especially for service on gas, alcohol, oil and gasoline stoves, and can be used for broiling fish, birds, oysters, steaks and chops. The construction is such that the heat is applied to both sides of the food to be cooked at the same time, and the outside or shell of the broiler deflects the heated currents from the flames directly against the food. A little trough catches the juices and allows them to run off into a drip cup.



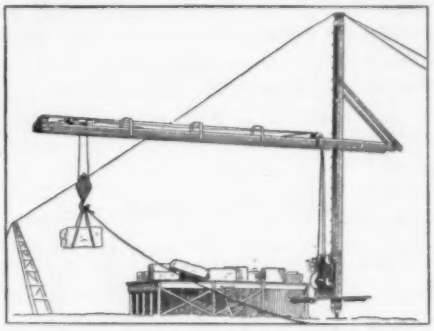
Broils and Toasts

ADJUSTABLE CONCRETE TANK MOLD

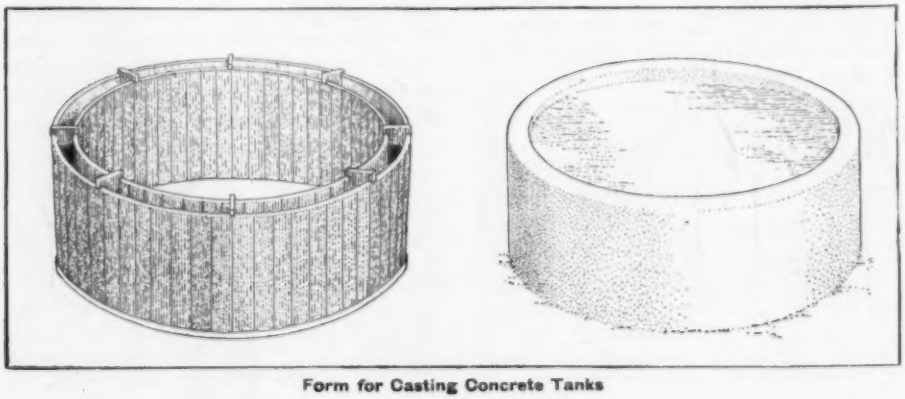
This concrete tank mold, patented by a Nebraska implement dealer who saw the utility of concrete construction as a means of increasing his business, can be adjusted to make any size tank required, both as to thickness of walls and diameter of tank. One of the illustrations shows the first tank produced by the use of the mold.

A SATISFACTORY 1-TON DERRICK

This 1-ton derrick, used for handling onyx at San Diego, Cal., is exceptionally handy. The mast is 12 by 12 in., and the horizontal beams, connected by the yokes shown in the illustration so as not to interfere with the running truck, are 4 by 14 in. The flanged wheels of the truck run on strips of iron fastened to the inside edges of the beams. The lifting cable is fastened to the extreme end of the beam and runs over a loose pulley on the truck to the pulley attached to the load hook, then back through another loose pulley on the truck to the mast again and down to the geared crab on the platform of the base.



Handy 1-Ton Derrick



Form for Casting Concrete Tanks